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Pedagogy in Basic and Higher Education

Current Developments and Challenges

Edited by Kirsi Tirri and Auli Toom

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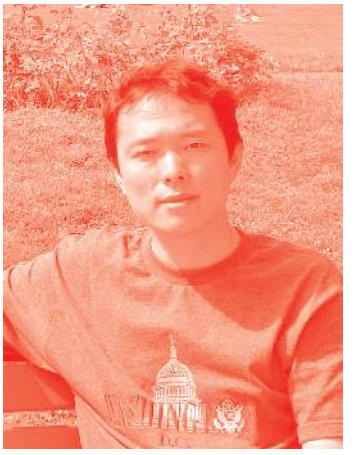


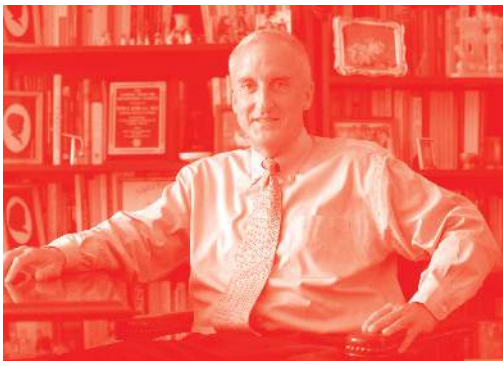

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Contributors
Duncan Mhakure, Eve Eisenschmidt, Kairit Tammets, Kätlin Vanari, Terence Lovat, Charles Enock Mulimba Ruyembe, Samuel Amponsah, Daniel Dei, Robert Osei-Bonsu, Allison Freed, Lacey Huffling, Aerin Benavides, Sarah Forster-Heinzer, Arvid Nagel, Horst Biedermann, Perry P. Gao, Carolina Zambrano-Matamala, Felipe Albarran-Torres, Pedro Salcedo-Lagos, Alejandro Diaz-Mujica, Darío Rojas-Diaz, Cristiana Levinthal de Oliveira Lima, Elina Kuusisto, Kirsi Tirri, Auli Toom, Anthony Sayster

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Meet the editors

Dr Kirsi Tirri is a Professor of Education at the Faculty of Educational Sciences, University of Helsinki, Finland. She is also a visiting Professor at St. John's University, New York, USA and University of Tallinn in Estonia. She has published widely in international educational journals and books on teacher education, moral education, and talent development. She also serves on the editorial boards of 13 educational journals. You can read more of her work at: http://www.helsinki.fi/~ktirri

Dr Auli Toom is a Professor of Higher Education and the Director of the Centre for University Teaching and Learning at University of Helsinki, Finland. She is a Visiting Professor at the University of Tartu, Estonia. Professor Toom is also the director of the doctoral program PsyCo (Psychology, Learning and Communication). Professor Toom is the President of the Finnish Educational Research Association (FERA). Her research interests include teacher knowing, competence, expertise, and agency among students and teachers. She investigates these factors in basic education, teacher education, and higher education contexts. She leads several research projects on higher education and teacher education. You can read about her work at https://researchportal.helsinki.fi/en/persons/auli-toom

Contents

Preface

Introduction: Holistic approach to pedagogy

In this book we take a holistic approach to pedagogy and argue that the purpose of education is to educate the whole personality of a student including cognitive, social, and moral domains. This kind of approach is worth implementing in both basic and higher education all over the world. We need more research on the wholeness of the teaching-studying-learning process that can be examined from different points of view. For example, teaching can be seen as a moral activity in which case the values and ethics in teaching become central in research. Different ways to study the interaction in schools and universities and the evaluation of teaching and learning are also important areas of research in pedagogy. Lifelong learning is one of the aims for the twenty-first century for both teachers and students. A pedagogically competent teacher pays attention to her students' abilities, gender, prior knowledge, motives, and expectations to make learning meaningful for them. Teamwork and co-operation among teachers, with homes and other institutions is necessary to provide the best possible education for our students. All these aims and demands create pedagogical challenges in schools and universities for which we should provide research-based and concrete help for teachers.

Meaningful education, learning, and wellbeing for students through teaching and partnerships

The book includes four sections and twelve chapters that address the current pedagogical challenges in basic and higher education in international contexts. In the chapters the authors describe the principles and practices through which meaningful education is promoted and enhanced in a variety of ways. They present the challenges educators face in their profession as well as ways in which they overcome the challenges. In the four sections of the book, these are thoroughly elaborated on, both theoretically and empirically. In addition, practical examples and ways of working in classrooms are provided in the chapters.

Section 1 Meaning of Education and Purpose in Teaching and Learning includes two theoretical chapters. In chapter 1 *"The Moral Role of Pedagogy as the Science and Art of Teaching"* the editors of the book, Kirsi Tirri and Auli Toom, present the theoretical framework of pedagogy and discuss the key concepts and actors in pedagogy and in pedagogical relationships in the context of educational institutions. Chapter 2 *"Values as the Pedagogy: Countering Instrumentalism"* by Terence Lovat emphasizes the moral nature of teaching and presents a pedagogy based on values.

Section 2 Pedagogical Wellbeing in Educational Institutions includes three chapters. Chapter 3 *"A Philosophical Outlook on Africa's Higher Education in the Twenty-First Century: Challenges and Prospects"* written by Dei Daniel, Osei-Bonsu

Robert and Amponsah Samual, provides an international perspective on 21st century education in Africa. In Chapter 4 *"Approach to Pedagogy and Scenarios Poor People Face in the Pursuit of Basic and Higher Education",* Charles Enock Mulimba Ruyembe elaborates on an interesting discussion on educational opportunities and equality. In Chapter 5, *"Using the Research Tutorial as a Training Strategy for Tutor Professional Development in an Undergraduate Course"*, Duncan Mhakure describes research tutorials as a framework to support tutors' work and further enhance student learning in higher education.

Section 3 Students in Basic and Higher Education includes five chapters. Chapter 6 *"The Power of Appearance: Students' Impression Management within Class"* by Sarah Forster-Heinzer, Arvid Nagel, and Horst Biedermann focuses on the students' behaviors in classroom interactions and allows readers to think of ways in which teachers could or should regulate them in a meaningful way. Chapter 7 by Anthony Sauster and Duncan Mhakure explores *"Students' Productive Struggles in Mathematics Learning"* in high school and demonstrates the productive struggles framework as a useful tool to analyze students' thinking processes in mathematics learning and teaching. Chapter 8, *"Perception of Student-Teachers Regarding Self-Regulated Learning"* by Carolina Zambrano-Matamala, Darió Rojas-Diaz, Pedro Salcedo-Lagos, Felipe Albarran-Torres, and Alejandro Diaz-Mujica, presents research results showing student teachers' perceptions and practices of self-regulated learning as well as challenges related to regulation of learning. Chapter 9, *"Teaching, Reflecting and Learning: Exploring Teacher Education Study Abroad Programs as Transformational Learning Opportunities"* by Allison Freed, Aerin Benavides, and Lacey Huffling, presents a case study on student teachers' perceptions of their cultural awareness and pedagogical decisions after long-term international exchange studies. Chapter 10, *"Categorization of Educational Technologies as Related to Pedagogical Practices"* written by Perry P. Gao, Arvid Nagel, and Horst Biederman, proposes a framework to consider analytically operational and pedagogical educational technologies, and whether they directly support the teaching and learning process.

Section 4 Educational Partnerships includes two chapters. Chapter 11 *"School-University Partnership for Evidence-Driven School Improvement in Estonia"* by Kätlin Vanari, Kairit Tammets, and Eve Eisenschmidt, presents the results of a study on strengthening meaningfully the evidence-driven school improvements through the partnership programs between schools and universities. In Chapter 12, *"Parental Engagement in Children's Learning: A Holistic Approach to Teacher-Parents' Partnerships",* Cristiana Levinthal and Elina Kuusisto present a holistic approach for a partnership between parents and schools that supports the holistic learning of students.

Conclusions

The book provides a current overview of pedagogy and pedagogical challenges internationally. Through the chapters, the importance of educating the whole human being is reflected. The book allows both researchers, teachers, and educational policy makers to reflect on the current developments, challenges, and areas

of development in educational institutions when aiming to support student growth and learning.

Kirsi Tirri
Professor of Education,
Faculty of Educational Sciences,
University of Helsinki,
Finland

Auli Toom
Professor of Higher Education,
Centre for University Teaching and Learning,
Faculty of Educational Sciences,
University of Helsinki,
Finland

Section 1

Meaning of Education and Purpose in Teaching and Learning

Chapter 1

The Moral Role of Pedagogy as the Science and Art of Teaching

Kirsi Tirri and Auli Toom

Abstract

The purpose of this chapter is to present the key concepts and actors in pedagogy and didactics in the context of institutional teaching. We present a holistic approach to education and view human beings as lifelong learners who need to be educated comprehensively to actualize their full potential. In this chapter we discuss how pedagogy, the science and art of teaching, can promote the educational goals identified in the curriculum. In this chapter we adhere to the Didaktik curriculum tradition in which values and morals are emphasized in guiding the teaching-studying-learning process. This means that pedagogy is moral in nature, and the teacher's main task is to reflect the values underlying her teaching and the purposes she wants to advance in her teaching. We also discuss the current pedagogical challenges in both basic and higher education in educating students for the twenty-first century.

Keywords: pedagogy, Didaktik, teaching, learning, values, moral

1. Introduction

The purpose of this chapter is to present the key concepts and actors in pedagogy and in pedagogical relationships in the context of educational institutions. The goals of education are established in a national curriculum and in more detailed institutional curricula. In many countries, for example, in Finland, the goal of education is to support the development of the whole personality, rather than merely the cognitive domain [1]. In this kind of holistic approach, human beings are lifelong learners who need to be educated in all educational domains to actualize their full potential. These domains include three domains in learning as identified by Benjamin Bloom: cognitive, affective and psychomotor [2]. Many learning tasks, for example, the skills related to morality, require teaching and learning in both cognitive and affective domains [3]. In this chapter we discuss how pedagogy, the science and art of teaching, can promote the educational goals identified in the curriculum.

We can identify two different curriculum tradition influencing national curriculums in different countries. The Bildung tradition aims at educating individuals to become competent citizens who actualize their individual talents and also benefit the society with their competences [4]. Bildung advocates the importance of individual and society transformation through education. In Europe and Nordic countries, *Didaktik* is a curriculum tradition guided by the philosophy of Bildung and the idea of educating instruction, *erziehende Unterricht*, *in educational institutions*. In that tradition, the pedagogical relation between the teacher and students,

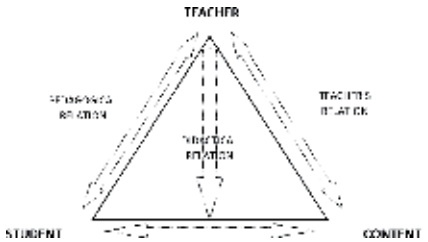

Figure 1.
The basic elements and relations in the didactical triangle [16, 17, 19, 22].

the content relation of a teacher to the subject matter and the didactic relation of a teacher to students' learning are seen as core elements in teaching-studying-learning process (see **Figure 1**).

In this *Didaktik* curriculum tradition both the teacher and the students have autonomy in teaching-studying-learning process that cannot be restricted by any legislation or evaluation [5]. The teaching is guided by a "Lehrplan" that can only be implemented by a competent teacher who has total freedom to choose her teaching contents and methods [4, 5]. The goals of curriculum and teacher's skills to actualize those goals in her teaching are the ways to evaluate the success of a teacher.

The Anglo-American curriculum tradition is based on psychological theories on learning, and the emphasis is on accountability and learning outcomes [6]. The curriculum and the teaching plans are well-articulated and detailed with the goals to achieve the learning objectives with clearly defined contents. The teachers are trained to teach certain contents with the goal to produce good learning results that can be measured objectively with standardized tests. Teachers are certified after their training, and they are evaluated regularly on the basis of their students' learning outcomes [4, 6]. Teachers' task is to implement the given national curriculum and achieve the learning objectives listed in them.

2. The moral core of pedagogy

In this chapter, we adhere to the *Didaktik* curriculum tradition in which values and morals are emphasized in guiding the teaching-studying-learning process and in educating pupils as whole. This means that pedagogy is moral in nature, and the teacher's main task is to reflect the values underlying her teaching and the purposes she wants to advance in her teaching. In addition to the values established in the national curriculum, the teacher needs to be aware of the ethical codes guiding the teaching profession. The professional status of teachers differs from country to country. In Finland, for example, teachers are considered ethical professionals who can be trusted and who share similar basic values about their work. These values are established in the ethical codes for teachers, which were first published in Finland in 1998. The values are dignity, truthfulness, fairness, responsibility and freedom [7]. In 2017 the Teachers' Union in Finland continued to strengthen the professional status of its members and established the Comenius' Oath for teachers [8]. The purpose of this oath was to support teachers and provide a concrete reminder of the ethical foundation of their profession. The freedom given to teachers challenges them constantly to develop their ethical skills with regard to their students, colleagues, themselves and the networks with which they cooperate. In this pedagogical challenge, teachers need ethical sensitivity to identify and solve context-specific moral dilemmas in teaching [3].

Shulman [9] argues that teacher's knowledge of ends, purposes and values of education is perhaps the most important part of teachers' professional knowledge. This kind of knowledge includes the following issues: the visions on what is possible in pedagogy, how a pedagogically well-functioning school might look like, what the students should become and how good education can be defined [9]. In Finland, for example, the holistic growth of students is emphasized in the national curriculum with the aim to educate them to be good citizens who contribute to the society with their talents [1]. This goal of education assumes that the teacher has internalized the values and purposes in education and can actualize them in her teaching. In addition to these general pedagogical values, the teacher needs to be aware of the subject-specific values of each subject taught [10]. A current pedagogical challenge for Finnish teachers includes the task of curriculum integration [11].

According to Niemelä and Tirri the need for an integrated curriculum emerges from current ethical and social issues in the world. Curriculum integration can be applied, for example, to teaching what climate change means and what can be done to stall, if not reverse it. Curriculum integration can also advance democratic education in schools with a pedagogical purpose of meeting the needs of diverse students [11].

To be able to act as an ethical professional with a long-term commitment, a teacher needs a personal purpose for her work [12]. William Damon and his colleagues have defined the term "purpose" as "a stable and generalized intention to accomplish something that is both meaningful to the self and of intended consequence to the world beyond the self" [13]. Tirri argues that to meet the criteria of a purposeful teacher, three criteria needs to be met. They include intention, engagement and prosocial reasoning [12]. Purposeful teachers are those professionals who have internalized the moral core of pedagogy and the long-term goals in education. Those goals need to be both personally meaningful for a teacher and at the same time go beyond herself to serve her students holistic growth.

3. Main concepts in the research on teaching

3.1 Pedagogy, Didaktik and didactics

In the Anglo-American contexts, the concept of pedagogy is usually used as a synonym to the German concept of didactics (die Didaktik). The *Didaktik* is an invention of nineteenth-century teacher education in Germany and in Nordic countries [5, 14]. In Anglo-American literature, the concept of didactics is used differently than in the European tradition. The term might have a negative connotation with the idea of direct instruction where a teacher is imposing her right doctrine to the student [15]. In this chapter we use the term pedagogy to avoid this kind of misunderstanding. This Anglo-American term might be the closest meaning to the European concept of didactics. With the term pedagogy, we address the whole "teaching-studying-learning process" in educational institutions that is actualized as "the science and art of teaching".

An important aspect of German Didaktik tradition and pedagogy is that it has both descriptive and normative aspects, science and art of teaching. In descriptive sense, *Didaktik* means science of teaching. It is research on the instructional process in its wholeness: the key actors—teachers and pupils—in institutional educational contexts as well as the relationships between the key actors and processes related to learning, studying and teaching. The descriptive *Didaktik* also informs the instructional practice and normative aspects of it. Pedagogy emphasizes values in teaching-studying-learning process, and they are also important issues in teacher's

planning, action and reflection. This means that education is normative in nature and teachers have important role as moral educators. Regardless of the subject matter or grade level taught, teachers are moral educators. Pedagogy also differs from educational psychology in its context dependency. This has implications to the teaching-studying-learning process which is intentional in nature, and teachers' actions are based on values and purposes, and the whole process is located in educational institution. Moreover, the teachers are educated in established educational programmes, and the studying and learning are guided with curriculum that defines the goals in learning [14, 15].

3.2 Educating instruction and the relationships between teacher and students

Teacher and students, content of instruction as well as the relationships between them mainly contribute on the quality of classroom interaction [16]. Several researchers [17–19] after Herbart have considers the basic elements—teacher, student and content—and relations in the didactical triangle (see **Figure 1**).

In this pedagogical core and context, the *teacher's main role* is to promote student learning. The teacher needs to be capable in terms of the content and student learning, be able to organize lessons, facilitate the interaction and solve challenges in classroom. The teacher also has to be capable in terms of educational aspects. The teacher needs to act intentionally and responsibly in relation to students, their learning and growth, and also as a role model and direction for them [20]. These actions are anchored on the teacher's moral and professional ethics, trust and respect between teacher and students [21], not on exercise of power or authoritarian behaviors. The *student's role* in pedagogical and institutional educational context is defined in relation to the teacher's role. Students are responsible of their own learning and behaviour in the instructional process. In its best, students regulate their own and other's learning by setting goals, striving toward them and evaluating their completion. *Contents* of learning and teaching are in a central position in the instructional process. They concretely encompass the matters included and written in the curricula of educational institutions that students are intended to learn.

The relations between the basic elements in the didactical triangle play an important part in the whole. Naturally, *teachers have relation to curricular contents* they teach. This aspect means especially teachers' mastery of the discipline-specific knowledge and skills explicated in the curricula. Also, *students have relation to curricular contents* they are about to learn. This covers students' attitudes, motivation, conceptions and experiences of curricular themes. This relation is realized in students' content learning [16]. The special qualities of *pedagogical relation between the teacher and student* stem from teacher's and student's roles in the didactical context. Functioning interaction between the teacher and students is necessary for the teaching-studying-learning process and for the best of student learning. The pedagogical relation is asymmetrical by nature in a sense that the teacher being more experienced aims to support students to learn certain capabilities. Pedagogical relationship is always interactive and dialogical, not one-way influencing or forcing a student on learning. The teacher acts altruistically through caring and encouraging students. Pedagogical relationship is always impermanent, and this characterizes the relationship since the beginning. The relationship changes and becomes gradually unnecessary, while students learn, develop and become independent and mature. Related to this aspect, pedagogical relationship is always future oriented. The aim is to support student learning toward the future possibilities and challenges by trusting on student's capabilities and success.

The *didactical relation meaning teacher's relationship to student's relation to content* is the core of the teaching-studying-learning process in the pedagogical core context

(see **Figure 1**). It combines teacher's relation to content and to students and basically describes the teacher's main task in institutional educational context. This relation covers all the actions that the teacher does to promote student learning.

3.3 Pedagogical content knowledge

In Anglo-American tradition, Shulman's [9] framework of the teacher's practical knowledge and especially pedagogical content knowledge has informed and guided research practice related to teachers and teacher education. He suggests that teacher education programmes should combine two knowledge bases to more effectively prepare teachers. These two knowledge bases are content and pedagogy. A crucial aspect of the teachers' knowledge development of how to teach their subject is subject matter knowledge. A second aspect of teacher knowledge is pedagogical knowledge, which goes beyond knowledge of the subject matter per se to the dimension of subject matter for teaching. Pedagogical content knowledge can be called as an amalgam between content knowledge and pedagogical knowledge; it allows teachers to support pupil learning, organize teaching in a pedagogically meaningful way and choose relevant teaching and assessment methods when teaching subject matter. Pedagogical content knowledge is unique to teachers and separates, for example, a science teacher from a scientist. With this knowledge, a teacher can teach a certain context to different learners effectively and with special attributes that help her/him guide a student to understand content in a manner that is personally meaningful [9].

According to Shulman [9], pedagogical content knowledge is an aspect of broader general pedagogical knowledge. General pedagogical knowledge comes close to the German notion of Didaktik, and pedagogical content knowledge comes close to the subject pedagogy or *Fachdidaktik* in German terms. The German researchers of Didaktik have started to use the term "school pedagogy" with which they refer to a broader institutional context of teaching in the school context. Kansanen [23] suggests a possibility of combining the promising aspects of pedagogical content knowledge and *Fachdidaktik* that might lead to new insights in future research.

3.4 Teaching-studying-learning process

The activities that invite students' knowledge construction in school include teachers' teaching and students' studying. Uljens [24] argues that both teaching and studying are intentional activities that are directed to promote students' learning. These activities are, however, not necessary prerequisites for learning; students can learn new things without intentional studying or teaching. In addition, teaching and studying cannot guarantee learning. According to Uljens: "Teaching and studying may thus be called activities supporting individual growth through the process of learning. Learning in itself is therefore a process, among others, through which individual growth is achieved. Competence and changes in one's personality may then be called the results of individual growth [24]".

Interaction between teacher and students, and among students, is fundamental in teaching. According to Husu [25], interaction seems to be important for at least two reasons: first, a certain amount of interaction is necessary so that teachers and students can understand each other and perform their teaching and studying activities. Without this basic interactive understanding, it would be difficult to know whether teaching and studying activities respectively are focusing in the shared aims that both teachers and students intend. Second, teaching and studying methods are interactive to varying degrees. They can be interactive in themselves

(discussion method), or they can allow interaction to a lesser degree (methods of student's individual studying) [25].

Kansanen [26] talks about indirect interaction that includes the pre-interactive and post-interactive phases that both teachers and students need in order to be prepared for the next instructional situation. When the teacher prepares for his/her lessons she/he must consider the previous study history and personal characteristics of the students. Furthermore, she/he must create an appropriate learning environment for heterogeneous group of students. The students, on the other side, must organize their own study schedules and do their homework.

We can conclude that the science and art of teaching can be found in purposeful, holistic, normative and context-dependent nature of teaching. Teaching requires strong subject matter knowledge, knowledge on students and the totality of the teaching-studying-learning process.

3.5 Current pedagogical challenges in basic and higher education

The professional task of the teacher is to create effective, supportive and challenging learning environments in which pupils can learn skills to direct their lives successfully. In this chapter we take a stance that education extends beyond acquiring knowledge or increasing cognitive capacities toward developing the whole person, including emotion, motivation, volition, spirituality and sociality [27, 28]. A current challenge in school pedagogy is to increase the intercultural and ethical sensitivities of students both in basic and higher education to be able to function as global citizens in the world of diverse values and cultures. Students need a clear purpose and goals in their own lives and in their studies to be able to plan their futures with goal direction and moral reflection on their choices beyond themselves. The teacher's task is to provide them encouragement, guidance and opportunities to find their own interests and become engaged both socially in dialog with peers and academically in terms of the learning contents in pedagogically supportive ways [29]. Teaching both in schools and in higher education institutions needs to adapt to the needs of twenty-first century learners and society.

Related to students' academic engagement, there exists a broadening discussion and also concerns about students' well-being both in basic and in higher education [30] that is constructed between students and the various learning contexts and interactions in them [31]. Several studies have identified factors that are related to students' decreased well-being both in basic and in higher education contexts, for example, learning difficulties, study-related burnout [32, 33], experiences of bullying [34–36] and loneliness in peer relations [37, 38]. These concerns encourage to think actively about the factors contributing to students' well-being and especially the structures and pedagogical practices in educational institutions. In the field of positive psychology, a variety of models based on empirical evidence have been constructed to structure the individual and contextual factors related to student well-being. Typically, self-acceptance, positive perceptions about one's own growth and development, conceptions of purpose of one's own life, positive relationships with others, environmental mastery and autonomy have been identified as key factors related to well-being [39–41].

The variety of digital technologies and social media can be used to support learning and stimulate the discussion on different cultures and the values underlying them. Students need to learn the skills in information and communication technology to be able to function as citizens in the twenty-first century. Many countries, for example, Finland has taken an active role in implementing information and communication technology (ICT) in schools and teacher education [42]. In the future vision, Finland is investing in digital teaching and learning and education of

teachers in their pedagogical use. This educational approach is a challenge for many teachers and students. Teachers might lack knowledge and skills to use relevant digital tools and pedagogies related to them to support student learning [43]. Teachers need to be educated for purposeful use of digital tools that includes paying attention to her students' abilities, gender, prior knowledge, motives and expectations to make learning meaningful for them. Students' skills in information and communication technology differ a lot, and teachers need the skills to differentiate teaching in inclusive classrooms [44].

Teachers are facing more diversity than before in their student populations. This will demand high-level ethical and pedagogical skills to cope with these new challenges. With the research-based education and professional ethics, teachers have the potential to meet the challenges of the future. In teacher education we can also identify the need for more education in the moral domain and particularly in moral sensitivities [3]. Teachers are facing more and more challenges due to the rising number of immigrant students and children who have learning difficulties. For example, in Finland, we have had serious problems concerning child welfare and school shooting tragedies that require new educational strategies and help from other professionals [45]. We can conclude that in addition to didactic aspect which is needed to help students improve their learning, teaching has a strong moral dimension, and teachers therefore need the moral competence to identify and solve moral dilemmas in their learning communities.

Author details

Kirsi Tirri[1]* and Auli Toom[2]

1 Faculty of Educational Sciences, University of Helsinki, Finland

2 Centre for University Teaching and Learning, University of Helsinki, Finland

*Address all correspondence to: kirsi.tirri@helsinki.fi

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Chapter 2

Values as the Pedagogy: Countering Instrumentalism

Terence Lovat

Abstract

The chapter sets out to identify ways in which the dominant pedagogy in the west has been shaped and influenced by instrumentalist imperatives emanating from the high age of logical positivism. It will furthermore expose the harm that has been done to education as a result, limitations on learning that are most apparent with the insights of updated sciences. The chapter will propose a values approach to pedagogy as a way of countering the narrow bounds of instrumentalism with an approach that possesses greater potential to address the whole person and the full range of human development measures, including personal, social, emotional, moral, spiritual and academic learning. The chapter will utilize international research that supports the beneficial claims of values pedagogy, with special reference to data from the Australian Values Education Program.

Keywords: values, values education, pedagogical approaches, curricular approaches, pedagogical leadership, holistic education, Australian education

1. Introduction

Ayer's [1] logical positivism had tried to ground all authentic knowing in the rational or empirically observable and/or measurable. Other than the "truths" contained in mathematics and logic, all other truth or assured knowledge claims were to be restricted to what could be empirically verified according to the so-called "Verification Principle" emanating from an eminent group of European philosophers known as the Vienna Circle [2]. The Verification Principle and its spawning in logical positivism were effectively outgrowths of nineteenth-century thinking resulting largely from conceptions of scientific method and supposedly assured scientific knowing held at the time.

During the nineteenth century and persisting well into the twentieth and even twenty-first centuries, scientific knowledge was believed to rest entirely on empirical methodology and so all human pursuits interested in knowledge were to follow suit. Among the human science disciplines, psychology and sociology developed in this way and, especially granted their influence on education, it was predictable that it would reflect these beliefs as well. Hence, as a highly influential influence, we find Tyler [3] generating a virtual empirical science around assessment regimes which, in the spirit of "teaching to the test," inevitably determined the direction of pedagogy. Bloom and associates [4, 5] built further on such thinking in the form of the taxonomies of educational objectives and their appropriate assessment regimes; these taxonomies drove generations of educational thinking, in turn also influencing the ways in which the principles and practice of pedagogy were enacted in schools. Thus, the foundations for instrumentalism in education were being well

set in place, with associated pedagogical assumptions and practice unrelenting regardless of masses of evidence of the damage that can be done by them to efficacious learning, not to mention that their own foundations in scientific thinking have come under increasing scrutiny. These claims will be substantiated in what follows and the terms of a values pedagogical alternative will be outlined and justified by reference to international research, especially in the data and findings of the Australian Values Education Program.

2. Countering positivism

Wittgenstein [6], in his famous work, *Philosophical Investigations*, refers to "reality" and the "facts" thereof as part of what he calls "language games." The gist is that the locus of human knowing is contained in language rather than empirically verifiable data. It was a subtle yet fundamental under-cutting of the basis of logical positivism and nineteenth century thinking about empiricism as the basis of all knowing. Ferre [7], in this regard, bespeaks a clear Wittgensteinian perspective in declaring that "facts are never given in isolation from the minds that receive them" (p. 761). Ferre implied that the things we call "facts" or verifiable data are really theories in the minds of the subjects who perceive them, and hence are less observable or least of all measurable than in the ways that logical positivists held to be determinative.

Such rejoinders were further reinforced by Lakatos [8] and Kuhn [9] who coined the notions of "touchstone" and "paradigm" respectively to connote the true basis of claims to "know." According to their theories, knowing is not merely a linear conforming of perception and reality, as the logical positivist would have it. It is not objective in the simple observable or measurable sense because it is infused with the subjectivity of the person doing the knowing. Quine [10] went on to show just how subjective were the assertions of those empiricists claiming to be objective: indeed, the Verification Principle itself defied the very rules which formed it in that it belonged to neither category of mathematics and logic nor of the empirically verifiable. Feyerabend [11] launched highly critical attacks on the ways in which education systems had applied logical positivist and/or simple empirical assumptions to curriculum and pedagogy, especially in the ways they had prioritized certain forms of knowledge over others, on the purported basis that they offered surer knowing (read the empirically verifiable knowing of science and technology mainly), while other forms of knowledge were relegated to the margins if not right out of education. See also Apple [12] on "high status knowledge" and the damage that such conceptions have done to the balanced curriculum and holistic learning.

The "certain forms of knowledge" to which Feyerabend refers is further enlightened in Habermas's [13, 14] "ways of knowing" theory. Habermas's explanation for apparently different forms of knowledge derives from his belief that knowing is impelled by a series of "cognitive interests," three interests which are effectively part of the way the human mind works. First, there is an interest in technical control which impels an "empirical-analytic" way of knowing. This is useful knowledge for performing fairly basic tasks of being able to put something together, find a place on a map, operate a machine, or for competence in the fundamentals of literacy and numeracy. Second, the interest in understanding meanings gives rise to an "historical-hermeneutic" way of knowing, the knowing that results largely from engagement, interrelationship and dialogue with others. This is a knowing that wants to get behind basic knowing to interpret what it might mean, for example, to understand the importance of what is being put together, the significance of the place on the map, the ramifications and potential impact of the machine's operations, and the full effects of literacy and numeracy, including their cultural significance and

differences. While empirical-analytic knowing does not require human interaction nor much in the way of imagination, historical-hermeneutic knowing requires both.

Third, there is an interest in being emancipated, a free agent as it were, which issues in a "critical" or "self-reflectivity" way of knowing, the knowledge that comes ultimately from knowing oneself. This is the knowing that causes us to reflect critically on our subject matter, our sources and ultimately ourselves as agents of knowing. Such agency impels us to go to any lengths to be assured that what we know is, as far as is possible, the unfettered truth, free of cultural bias and partial interpretation, including as those might function in ourselves. For Habermas, this way of knowing provides for the only truly assured, totally comprehensive and authentic human knowing. It is a deeply moral knowing in that it drives fearlessly beyond the politically correct or skewed, the safe, and the partisan interested, including as these blind spots play out in oneself. It requires profound forms of human encounter and ultimately of self-knowledge. It also requires much in the way of imagination. Habermasian literature, primary and secondary, is replete with the notion of imagination as a prerequisite for knowing of the fullest kind. Indeed, against both modernism's and especially post-modernism's unimaginative conceptions of the Enlightenment project, he proffers that what they have robbed us of is "… the spontaneous powers of imagination, of self-experience and of emotionality." ([15], p. 13) For Habermas, this is an aberration of what the Enlightenment project was intended to do [16, 17].

In this work, Habermas illustrates well, among other things, the limitations of logical positivism's conception of knowing and all it has led to, the limitations being set essentially around a knowing of basics, a knowing he describes as empirical-analytic, useful for certain basic knowledge and skills but a long way from the full reaches of knowing. It is an especially long way from the more sophisticated knowing related to interpretations and meanings, and the more moral knowing that entails deep human encounters and, finally, a ruthless self-knowing, all of which require deep levels of imagination and emotionality. Seeing it this way helps to understand why Feyerabend was so critical of education that prioritized more basic knowing to the exclusion of holistic knowing.

3. Changing understandings of science

Even as the terms of nineteenth century positivism were being laid, such as bespoken in the Verification Principle, so the critique was underway, a critique that, from Habermas's point of view, has not been taken seriously and from Feyerabend's view, has impacted negatively on education. For Habermas, knowing required a fortified hermeneutic dimension which ultimately could lead to the more sophisticated knowing connoted in being an agent of knowing, in his sense. Habermas [15] is quite explicit that, for him, his thinking here owes much to Husserlian philosophy. Husserl [18] was a nineteenth century empiricist who saw even then the limitations of the narrower assumptions and functioning of a simple understanding of empiricism, ones that emanated from the Verification Principle and became the basis of logical positivism. He described this kind of empiricism as "descriptive science," fundamentally the same conception as to be found in Habermas's empirical-analytic knowing, the knowing of basic facts and figures, purely descriptive knowing.

While a useful foundation for scientific knowing, for Husserl, it lacked the more important and essential human knowing that was the product of what he referred to as "eidetic science," the knowing and understanding of meanings, of different perceptions that can only be unraveled by human beings interacting and by deep forms of reflective learning. Eidetic science was heavily subjective and that was the very thing that was being in a sense forbidden by the obsession with descriptive science,

creating in turn an inherent obstacle to deeper forms of learning. For Husserl, human sciences had to include a human element and yet that was being denied to them by the scientific assumptions of the day. The irony herein was that knowledge of the deeper kind was being blocked in the name of a science purporting to be the means of all knowing. The same irony is reflected in both Habermasian epistemology and Feyerabend's and Apple's reflections on what was ensuing in education. In the name of sound education, sound education was being denied. So what are the assumptions that led to this anomaly and how can they be broken down and re-formed in the interests of truly sound education? Well, the path and history of science itself, the very discipline that is purported to lie at the foundations of the assumptions, are instructive in this regard. The two exemplars by which I choose to make that point are the sciences of astrophysics and neuroscience.

3.1 Astrophysics

For Husserl, truth was best understood as ever elusive, rather than easily grasped in the way of simple empiricism, and so the truth seeker had to proceed with caution. Good science was a humble rather than arrogant methodology around alleged "certainties" that the tenets of descriptive science had led to. Good science was replete with imagination. Husserl's caution about science is interestingly prophetic when one considers the far greater caution detected in much modern science, such as astrophysics, for instance. Against all the alleged certainties premised by earlier empirically bound method, we find find de Grasse Tyson [19] referring to dark energy and dark matter as a "mysterious presence," constituting 96% or so of the known universe, responsible for maintaining it the way it is, yet about which we are "clueless." He describes dark matter as our "frenemy," part friend, part enemy: "We have no clue what it is. It is kind of annoying. But we desperately need it in our calculations to arrive at an accurate description of the universe." (p. 62).

De Grasse Tyson speaks frequently about the need for high levels of cognitive imagination for modern astrophysics to proceed. He underlines this point by reference to Albert Einstein, fairly unarguably the greatest scientist to ever live, yet one not given at all to simple empiricism or to being limited by Husserl's notion of descriptive science. He says of Einstein that he "... hardly ever set foot in the laboratory; he did not test phenomena or use elaborate equipment. He was a theorist who perfected the "thought experiment," in which you engage nature through your imagination" (p. 62). De Grasse Tyson refers to the book, titled, *100 scientists against Einstein* [20] showing how these mainly simple empiricists (Husserl's descriptive scientists) were wrong and Einstein's imaginative methods (Husserl's archetypal eidetic scientist) were ultimately proved correct. As examples of the limitations of their simple empiricism, some of Einstein's critics described as "fantasy" the notion of the so-called "cosmic constant," the central tenet in his theory of relativity. In fact, the "cosmic constant" was finally ratified with a measure of empirical evidence in 1998 [21], something further demonstrated by the famous 2016 gravitational wave detected by the Hadron Collider [22] and to an extent ratified even further by the famous and ground-breaking picture of the black hole in 2019 [23].

Einstein's knowing was finally endorsed by highly sophisticated forms of empiricism but the basis and impulsion of his knowing came not from empirical method but from what I refer to as imaginative method. On the other hand, the reliance on a simple empiricism on the part of the 100 adversarial scientists blinded them, while Einstein's on imagination released him to speculate on realities that were quite beyond empirical verification of the kind most scientists of the day were relying on. In Husserlian terms, it illustrates the reliance for holistic knowing purposes on descriptive and eidetic sciences intersecting and interacting. In Habermasian terms, the 100

scientists' cognitive interest was in control, where Einstein's was in imaginative exploration of the kind that characterizes the true agent of knowing. He wanted to know the truth and to get there he had to go beyond the bounds of controlled knowing. There is a lesson here for all learning ventures, including school-based pedagogy. Over-controlling of the knowledge process in the form of endless measuring of outcomes, accountability and assorted forms of instrumentalism can actually create blind spots and retard knowing of the most important kinds. On the other hand, releasing and nurturing the imagination might well be the most useful thing that schools can do.

3.2 Neuroscience

Updated neuroscience is another science that, in many ways, takes us to the same place. Damasio [24] and Immordino-Yang [25] refer to the enriched cognitive functioning, especially around imagination that ensues when discourse of any kind takes account of emotionality and sociality. In reference specifically to school-based discourse, Damasio and Immordino-Yang [26] have this to say:

> *Modern biology reveals humans to be fundamentally emotional and social creatures. And yet those of us in the field of education often fail to consider that the high-level cognitive skills taught in schools, including reasoning, decision making, and processes related to language, reading, and mathematics, do not function as rational, disembodied systems, somehow influenced by but detached from emotion and the body. (p. 3)*

Narvaez [27–30] builds on these ideas, both as a neuropsychologist and educator, in the ways she positions imagination as the confidence-builder and architect of the mindset essential to what she refers to as "efficacious learning." She ties imagination, emotion and cognition together in suggesting that it is imagination that unlocks the emotions that are needed for sound reasoning. In a word, reasoning is both rational and emotional. The mind thinks both logically and emotionally.

Narvaez focusses much on the ways in which human knowing has worked over the millennia of human existence, a process that in a sense is repeated each time a new life comes into the world. Among her specialities is early childhood education where imagination is the key or, if not stimulated, it is the death of efficacious learning. Yet, in the face of any amount of evidence, including in the different ways in which the scientific base of instrumentalist pedagogy is changing, instrumentalism in pedagogy and education generally seems to be the standard modus operandi of educational systems. The desire for accountability, invariably motivated by political agendas, including of control, rather than inspired by educational theory, drives systems towards the most easily measurable, invariably the basics, Habermas's empirical-analytic knowing, Husserl's descriptive science, Damasio's and Immordino-Yang's disembodied systems. When this drive becomes an obsession, affecting individual schools' reputations, the key performance indicators of school administrators, the political slogans of governments and oppositions, the "be all and end all" of ranking in international testing, then the casualty is imaginative pedagogy and its associated efficacious learning. Let me offer one example of this, an example from Australia.

4. Instrumentalist pedagogy alive and well

NAPLAN (National Assessment Program Literacy and Numeracy) was established by the Australian Government in 2008. It is a national literacy and numeracy testing mechanism administered at four levels across primary and secondary

education. It is mandatory for any school wishing to maintain government registration. Its results are inserted into a software program called "My School" (comprising a large data set about each school's numbers, demographics and, once imported, NAPLAN test results). This import was designed to show which schools were doing well in literacy and numeracy and which were not. It quickly became a ready-reference for parents in their school selection, a serious reputational issue for schools and a crucial KPI (key performance indicator) for school administrators.

NAPLAN had two main stated purposes: first, it was to strengthen literacy and numeracy levels of Australia's young people; second, it was to improve Australia's standing in the OECD international testing mechanism, PISA (Program for International Student Assessment). Evidence suggested, after 10 years, that there was no indication that either objective had been achieved in any substantial way. According to one study that typified the national result, literacy and numeracy levels had not improved, at least according to the limited NAPLAN device itself [31]. Additionally, Australia's standing in PISA was demonstrably worse than before NAPLAN began [32].

At the time of writing, there is a strong push coming from powerful education entities, bureaucracies, teacher unions and teachers themselves that NAPLAN has so skewed the imperatives of education that it constitutes a menace to efficacious learning. Furthermore, research evaluations of the mechanism testify that it has "... a narrow focus on a limited set of skills rather than developing capacity..." The same research identified the following problems:

- *the NAPLAN tests added little to teachers' understanding of students' literacy levels*;
- *the assessment was a poor measure of student achievement*;
- *the tests had little relation to students' lives, or to their future job prospects*;
- *pressure to prepare students for NAPLAN detracted from other learning opportunities*;
- *stress around the inflated importance of the test negatively impacted some students' wellbeing*;
- *pressure to "teach to the test" frustrated many teachers, reducing their sense of professional autonomy [33]*.

Meanwhile, an international testing expert declared NAPLAN to be "bizarre" in its inappropriateness. It is directed at all the wrong kind of learning and actually encourages bad writing [34]. Most recently, the federal government's own national policy and practice entity, the Gonski Institute for Education, called for its "ditching" [35]. In a word, NAPLAN has become synonymous with bad teaching and incompetent, negligent and damaging education. It is not simply that NAPLAN has achieved nothing worthwhile. The more damaging finding from evaluation is that it has become a threat to the business of sound education and has malevolently influenced school-based pedagogy.

NAPLAN created a stressful, needlessly competitive and, in that sense, unsafe environment for learning. Furthermore, it failed to impact positively on the very academic learning that was its principal target. It is a prime example of a pedagogical approach driven by the linear assumptions of logical positivism and ignoring the wisdom to be found in the philosophical and scientific perspectives outlined above. I now wish to summarize briefly the very different effects of a values pedagogy, drawing on evidence principally from the Australian Values Education Program. In

contrast with instrumentalist pedagogy, it emanated in what I describe as imaginative pedagogy, a pedagogy that elicited the imaginative capacities essential to the most effective forms of learning.

5. Findings from the values pedagogy projects

Narvaez [27–29] makes the point that imaginative pedagogy is not always the result of spontaneous impulses. It requires both the safe environment and the guiding hand of craftily planned pedagogy. It is another way of talking about the two-sided coin of values pedagogy, the implicit side being the safe, values-filled learning environment and the explicit being the values-focused pedagogy.

By implicit is meant that the learning environment must be values-filled, characterized by care, trust, respect and encouragement. There is any amount of research that has demonstrated the importance of the values-filled "ambience," as Newmann [36] described it. Newmann's work was in the area of "authentic pedagogy," the pedagogy most associated with teaching that works best. Findings from his research were factor analyzed into five "pedagogical dynamics," five features or characteristics that seemed to sum up the things most obviously associated with teaching that was working, achieving its goals, including academic achievement. The last and most important was the "ambience of care and trust." The ambience of care and trust is the starting point, or *sine qua non*, of values pedagogy. The learning environment must be characterized by care and trust, positive relationships and safety and security [37–39].

The explicit side of the coin is seen in the orientation of the learning discourse being around values, the values inherent in curriculum content, rather than merely the "facts and figures" or most easily measurable features of the content. One of the many misconceptions about values pedagogy is that it means doing something additional to the standard curriculum. In fact, it does not require separation from the curriculum; rather, it determines the direction of the curriculum through *becoming the* pedagogy.

The content of any curriculum area tends to focus on the facts and figures (what Habermas calls the "empirical/analytic") relevant to the area in question. Why? Because that is the most easily measured. When employed judiciously and seen as first step or means to a greater end, this can assist in the foundations of sound pedagogy. On the other hand, when it is seen as the entire step or end in itself, it becomes a malevolent force against sound pedagogy, instead settling for what I am describing as instrumentalist pedagogy. As most teachers know well, the more education that follows this kind of instrumentalism, the more boring it risks becoming, the more skewed in favor of those with retentive memories and the more unfair and potentially damaging it becomes to those many people who learn better in other ways. Additionally, the case being made above by the likes of Habermas and Narvaez is that, important as the facts and figures might be, the less we stimulate the interpretive, critical and imaginative ways of knowing, the more we stifle efficacious learning, and indeed the more we risk atrophying cognitive powers generally. In that sense, instrumentalist forms of pedagogy risk "de-educating" and stifling learning potential, rather than the opposite that is intended.

So, in the values pedagogy work as it functioned in the Australian program, all extant content was derived from the set syllabuses but instead of settling for the standard objectives, largely the easily measurable ones, the values inherent in the content became the focus, thereby stretching rather than limiting the cognitive powers being called on. In other words, instead of simply rolling out the content because it was there in the syllabus and because a measurable outcome for reporting was demanded by the system, lessons were begun with questions like "what value is

in this content? What value for students' important knowledge, vital understanding of the world into which they are moving, crucial skills and competencies for future work, important insights for their wellbeing and the wellbeing of those with whom they will form relationships? What value is it to their future personal and social development? What value is it for the world in general? What vital lessons about humanity and the Cosmos, if any, might be contained in this content?"

Evidence suggests that when these kinds of values questions were stimulating and determining the pedagogical direction, then the easily measurable content knowledge fell out anyway and, in all irony, students were actually more likely to remember the facts and figures at the center of such content knowledge, far beyond the measuring device, because of the contextual stimulation that was being applied. In Habermasian terms, interpretive, critical, self-reflective and imaginative knowing was being impelled. Data from the projects testifying to these claims include the following:

> *The pedagogies engage students in real-life learning, offer opportunity for real practice, provide safe structures for taking risks, and encourage personal reflection and action ([40], p. 9).*
>
> *(Values pedagogy) ...requires students to scrutinise questions that are difficult to resolve or answer, and focus on listening, thinking, challenging and changing viewpoints within a guided and safe environment ([40], p. 28).*
>
> *The structured discussion and agreed values that govern the engagement provide safety and support for students as well as an expectation that correction and revision are part of the debating process. It promotes critical thinking and encourages an obligation to respect one's fellow inquirers. It attempts to produce better thinkers and more caring members of society, who accept differences and, at the same time, submit conflicts to reasonable scrutiny ([40], p. 28).*

The justification of such findings against Habermasian theory was summarized in the following way:

> *The frame of reference emanates from Habermas's 'Ways of Knowing' and 'Communicative Action' theories. In a word, it is the one who knows not only empirically analytically and historically hermeneutically, but self-reflectively who is capable of the just and empowering relationships implied in the notion of communicative action. In a sense, one finally comes truly to know when one knows oneself, and authentic knowing of self can only come through action for others, the practical action for change and betterment implied by praxis. Habermas provides the conceptual foundation for a values education that transforms educational practice, its actors in students and teachers, and the role of the school towards holistic social agency, the school that is not merely a disjoined receptacle for isolated academic activity, but one whose purpose is to serve and enrich the lives not only of its immediate inhabitants but of its community. ([39], p. 220)*

In the projects that ran as part of the program, there were what were described as predictable, less predictable and quite unpredictable results. The predictable results were that students' accrual of important *personal and social values* was strengthened and affirmed. These were predictable in the sense that any curriculum intervention inputs a particular discourse, words, phrases, terms and concepts even in the setting up phase. One then will find that discourse coming through in the implementation and assessment phases; it would be a fundamental sign of failure if that were not the case. Hence, the inspirational document, the so-called *National*

Framework for Values Education in Australian Schools [41, 43], contained much explicit values discourse and predictably then there was a lot of similar discourse to be found in the evaluation phase, be it coming from teachers, university researcher participants, parents or the students themselves:

> *Everyone in the classroom exchange, teachers and students alike, became more conscious of trying to be respectful, trying to do their best, and trying to give others a fair go. We also found that by creating an environment where these values were constantly shaping classroom activity, student learning was improving, teachers and students were happier, and school was calmer. ([42], p. 120)*

Moreover, there were less predictable results in the form of a plethora of discourse about improvements in *student behavior and teacher and student wellbeing*. Such discourse was less predictable in the sense that behavior change and wellbeing were not explicit target outcomes for the projects. Nonetheless, this discourse was commonly to be found at the evaluation phase:

> *… the documented behaviour of students has improved significantly, evidenced in vastly reduced incidents and discipline reports and suspensions. The school is … a "much better place to be". Children are "well behaved", demonstrate improved self-control, relate better to each other and, most significantly, share with teachers a common language of expectations … Other evidence of this change in the social environment of the school is the significant rise in parental satisfaction. ([42], p. 41)*

Then there was the unpredictable category of discourse around academic attention (what we eventually described as academic diligence). There was no discourse whatever in the set up about academic improvement yet it began appearing very early on in the feedback process and then continued as a persistent feature of evaluation. It was initially referred to as a "surprise effect" [44] and impelled much of the searching out of the literature (Habermas, Narvaez, etc.) noted above in order to try and explain it. As they show, be it from a philosophical or neuroscientific perspective, a pedagogy that provides a caring, positive relational and safe learning environment (the implicit side of the coin), along with an approach to content that challenges interpretive, critical, self-reflective and imaginative pedagogy is likely to result in, as Narvaez would put it, the kinds of emotions that make for sound reasoning. In this sense, the surprise is not such a surprise. The surprise is, rather, that we so easily forget such fundamentals.

The issue of the unpredictable academic diligence being enhanced was one that required especial attention when the results were being finally evaluated and all claims were subject to their own testing and measuring in the project titled, *Project to Test and Measure the Impact of Values Education on Student Effects and School Ambience* [45]. The Executive Summary of this project summarizes the findings around academic diligence as an improvement factor in the following paragraph:

> *Thus, there was substantial quantitative and qualitative evidence suggesting that there were observable and measurable improvements in students' academic diligence, including increased attentiveness, a greater capacity to work independently as well as more cooperatively, greater care and effort being invested in schoolwork and students assuming more responsibility for their own learning as well as classroom "chores." ([45], p. 6)*

Full and complete details of how this project functioned methodologically can be found in Lovat and Dally [46].

6. Discussion and application

The great Muslim scholar of the Middle Ages, Abu al-Ghazali had much to say about educational wisdom [47, 48]. Amidst the wisdom are words about the imperative for good learning to be prefaced by the instilling of imagination and the eliciting of wonder. These are the foundations of enduring learning, or what we might refer to as lifelong learning. A pedagogy focused too much on prescriptive teaching and persistent testing will retard progressive learning, while one centered on imagination and wonder can facilitate the desire to continue on the learning path. In many ways, Ghazali was an educational neuroscientist well before his time. His perspective also underlines why it is that values pedagogy contains a potential to lay the foundations for lifelong learning.

Indeed, there is a literature that deals precisely with the connection between values pedagogy and lifelong learning [49], including higher learning. As described, values pedagogy has potential to inflame the cognitive interests that impel those higher forms of learning that are essential to the kinds of critique that an informed populace requires of its citizenry, including the original and innovative thought associated with doctoral learning, as an example drawn from the parameters of higher education [50, 51]. This underlines the importance of such a pedagogy not only for maximizing learning breadth and depth in schools but also for the kind of learning that leads to the highest forms of intellectual achievement such as are crucial to individual wholeness and to a successful, moral and harmonious citizenry.

Ghazali's de facto motto was to ask many questions and allow the answers to come from the learner rather than the teacher. Above all, not to provide answers to questions that had not even been asked by the learner. Yet, of course, much education at all levels does precisely what he advised not to do. This is at the heart of instrumentalist pedagogy and it explains why it can do such damage to learning potential, especially in the long term. It can offer the kind of short term learning required for immediate tasks and satisfying testing requirements but it offers little to lifelong and/or higher learning and, furthermore, can work against it. The effects of such are multiple, ranging from a narrowing of the kinds of critique necessary to overturn age-old prejudices that lead invariably to dysfunctional societies and a fractious world through to a surfeit of doctoral candidates in universities who are less equipped than they should be in independent learning strategies. In this sense, instrumentalist pedagogies are formulas for retarded learning, while values pedagogy has the potential to lay the foundations for progressive learning.

The challenge for educational institutions at all levels is to take heed of the multiplicity of research that underpins the claims being made here. We live in an era that is blessed with the scientific understanding of learning that Ghazali did not possess. Yet, the irony would seem to be that he might well have understood intuitively how efficacious learning should proceed, regardless of the lack of evidence. On the other hand, many modern educational regimes have the evidence before them but ignore it and establish regimes of learning that are actually hostile to efficacious learning. The Australian NAPLAN example above is just one of any number of examples from school and higher education regimes that could be cited of negligent and damaging practice underpinned by an instrumentalist set of assumptions leading to instrumentalist pedagogies and a narrowing of the scope of learning.

Especially as education becomes more of a mass industry and resources become invariably lean, the temptation to establish perfunctory goals at the lowest level of what Habermas calls empirical-analytic knowing becomes particularly coercive. This is especially the case because the output of such knowing is the most easily measured. School and higher education regimes can therefore easily fool themselves, through the record of measurements, into thinking that good outcomes have

been achieved and good learning has been facilitated, where in fact the foundations of lifelong and higher learning have been damaged and retarded. This is a challenge indeed for the modern education setting, wherever and at whatever level. Granted these challenges, research around values pedagogy presents as a viable, inexpensive way forward.

7. Conclusion

The chapter has set out to debunk the kinds of instrumentalist pedagogies that abound in educational systems both for their conceptual weaknesses and failure to keep pace with the very scientific understandings on which they rest and for the demonstrable damage they do to young people's learning potential. It furthermore proposes a values pedagogy as an approach with potential for obverse effects, one that ensures the right environment for learning as well as the kind of intellectual stimulation required for the imagination that spurs the emotions that impel sound reasoning. In a word, instrumentalist pedagogy survives as a tool of political agendas and populist media, whereas values pedagogy rests on the firmest evidence from philosophical and neuroscientific research about how the mind works, the brain functions and how efficacious learning is therefore best effected.

Author details

Terence Lovat
University of Newcastle, Newcastle, Australia

*Address all correspondence to: terry.lovat@newcastle.edu.au

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Section 2

Pedagogical Wellbeing in Educational Institutions

Chapter 3

A Philosophical Outlook on Africa's Higher Education in the Twenty-First Century: Challenges and Prospects

Dei Daniel, Osei-Bonsu Robert and Amponsah Samuel

Abstract

Higher education is perceived as key to the comprehensive development of Africa. In line with this perception, various governments have initiated several policies and models in an attempt to build quality higher education for developing Africa's human capital to positively respond to the global challenges of the twenty-first century. Despite these efforts, an observable gap still exists between higher education and socioeconomic development of Africa. This gap raises the question of how the quality of higher education in Africa could be improved to make the needed contribution to the comprehensive development of Africa. This chapter casts a philosophical outlook on higher education in Africa and doubts its relevance in Africa. The chapter reveals that commercialization of teaching and learning, scarcity of qualified faculty, inadequate resources for research, and ineffective governance of higher education institutions hinder African higher education from playing its role as a development agent. The chapter further claims that research collaborations across disciplines in higher education institutions, improvement in irregular/nontraditional modes of teaching and learning, utilization of student-based learning models, and restructuring the governance of higher institutions will help the African society reimagine the significance of these institutions to the socioeconomic developmental goals of the African society.

Keywords: higher education, Africa, methodic doubt, challenges, prospects

1. Introduction

Higher education describes systematic learning that takes place in the universities and colleges or other equivalent institutions of learning mostly termed tertiary institutions refer to higher education institutions. A survey of higher education institutions in Africa's ten most populous countries (Nigeria, South Africa, Ethiopia, Democratic Republic of Congo, Egypt, Sudan, Uganda, Algeria, Kenya, and Tanzania) indicates the existence of over 740 universities and colleges in Africa which are supported by both governments and private entities. As home to the world's oldest universities, the University of Al Qarawiyyin in Fez in Morocco (founded in 859 AD) and Al-Azhar University in Egypt (founded in 970 AD), [40] the continent is not oblivious of the benefits of higher education. Yet society

is sceptical about the kind of knowledge, skill and competencies graduates from higher institutions possess.

Although, governments in some African countries such as Kenya, Uganda, Ethiopia, Tanzania, Egypt, and South Africa have invested hugely in both public and private tertiary institutions. Such investments seem to have paid off locally. A 2016 Times Higher Education ranking identified 15 best universities in Africa. Among these, six were from South Africa, three were from Egypt, two were from Morocco, and one each from Ghana, Kenya, Nigeria, and Uganda [1]. But African Universities appear inferior to their counterparts in other continents. For example, the Edition 2019.1.2 of Webometrics indicates that the best university in Africa, University of Cape Town, ranked 272 on the world ranking [2].

This meant that the best of African universities was missing on the intercontinental list of 250 best universities. Interestingly, South Africa had eight of the top ten best African universities. Perhaps, South Africa has found an antidote to the declining underperformance of universities in Africa. Could national funding of research policy be the reason for its relative success on the continent? This question and the queries raised so far begin the probe into the relevance and impact of African Universities. This study inquires into the objectives and roles of African universities in a quest to determine challenges obstructing these universities from achieving their objectives. In this regard, the study will identify prospects for harnessing the potentials of universities in Africa.

Through the philosophical approach of methodic doubt [3], the study distrusts the relevance and impact of Africa universities, formulates a challenge-based argument that explains the underperformance and reduced impact of African universities, and argues for a solution based on identified prospects. The study casts doubts on all existing views on the relevance and impact of higher education in Africa in an attempt to arrive at indisputable recommendations for enhancing the relevance and impact of higher education in Africa. Rational analysis enabled secondary data on Africa's higher education to be examined in light of the identified challenges and prospects on the continent. The thrust of this chapter is that concerted efforts by all stakeholders, reviewing teaching and learning approaches by incorporation nontraditional modes and restructuring governance systems in higher education institutions can aid universities in Africa to contribute significantly to the comprehensive development of the continent.

2. Doubt of the relevance and impact of Africa's higher education institutions

Universities in Africa, like their counterparts elsewhere, are established to achieve lofty goals, but the continuous underperformance and low impact of these universities make these goals a mirage. Also, African universities seek to achieve the goals of a twenty-first century education institution wherein "knowledge producers, values and culture transmitters, and capacity builders" ([4], p. 221). In light of these goals, African tertiary institutions are seen as centers of learning for the development of Africa's human capital and agency for the enhancement of the African identity.

In contrast, the creation of national and African identities [5] bemoans how Western education philosophies have been wholly accepted in the African education system at the detriment of indigenous knowledge systems. The authors are of the view that current Western philosophies of education can be perfectly integrated into the indigenous education system. As centers of learning and the development of Africa's human capital, these tertiary institutions are expected to acquire theoretical and

practical information about issues and concepts relevant to the African community, process this information through systematic categorizations, and transmit this categorized knowledge to their students. African universities perform this task through research, assessment, and teacher-student engagements in both curricular and extracurricular activities. Once again, this highlights the call for African philosophies to form the framework for education in the continent [6] in order to make teaching and learning more relevant to students in African higher education institutions.

It is worth noting that the significance of these universities is mostly viewed by society through the performances and competencies graduates bring to bear in their attempt to resolve challenging issues [7]. As such, society expects that these graduates will leave the universities with a body of relevant knowledge, ability to use this knowledge in the society meaningfully, and skills to apply knowledge to solve the myriads of problems facing countries on the continent [7]. After all, society prides itself in the high-level human workforce who not only exhibit knowledge but use this acquired knowledge to brace up society for the extensive changes of the twenty-first century [8].

Given the considerable number of graduates produced annually by Africa higher education institutions and the disconnect between the industry and the knowledge and skill base of these graduates, one could argue for the relevance of establishing these universities. African societies do not just need the numbers because there must be commensurate quantity given that graduates are required for societal transformation given the pressures and opportunities of the twenty-first century. However, the high rate of graduate unemployability across the continent casts a slur on the relevance of African universities, bringing into the fore the question raised by Mouton et al. [9] on the relevance of these institutions on the continent. This unfortunate phenomenon has been blamed on the mismatch between graduate competencies and industrial/societal needs [10]. This has opened a Pandora box for both society and industry to question the worth of university graduates. Some university graduates are themselves not so hopeful of their future in terms of acceptance into the workplace and the contributions they can make.

To further highlight the situation under scrutiny, [11] reported that 25% of graduates from African universities were unemployed. In a similar instance, the [12] quoted the president of Coco-Cola Company as claiming that 50% of the annual 10 million university graduates that churned out of African universities were unemployed. Additionally, Osazuwa [13] pegged graduate unemployment in Nigeria at an alarming 70%. Whereas in South Africa, the economic powerhouse in Africa, [39] indicated that graduate unemployment was ~14.9%.

The picture painted above may readily suggest that high graduate numbers will result in unemployment when more jobs are not created. However, the situation is different in the case where it is noted that only 50% out of annual university graduates in Kenya are suitable for employment [14]. The report further indicated that less than half of this percentage possessed the requisite soft skills for their preferred careers. The lack of soft skills and mismatched knowledge and job requirement corroborates an earlier report by the [15] and that of the [10] which collected data from 36 Africa countries established a mismatch between university degrees awarded and "career paths such as telecommunications, engineering, agriculture, Information Technology, health, banking and education" [10].

Sadly, Wambugu et al. [16] argued that "African tertiary graduates are weak in problem-solving, business understanding, computer use, and communication skills." Relatedly, Ncube [17] picked a compelling sentence from the keynote address by Professor Emmanuel Ngara of African Association of Universities in what follows:

> *Many African tertiary institutions produce half-baked graduates that aren't fit for the world of work mainly because of the way they are taught and the absence of curricular reviews that should respond to the calls of industry's contemporary needs.*

As authors of this chapter, we note that entrance into African higher institutions are highly competitive and the best candidates are often offered admission until the throughput is overhauled to fill the mismatch the relevance of African universities in terms of graduate output will continue to be in doubt.

Apart from the socio-economic function of African higher institutions, there is a greater expectation that these institutions will be agencies by which the goal of constructing an African identity in the twenty-first century can be realized. Africanization is a concept that highlights the need to determine and sustain the personhood and the relationship of the African people in a globalized world [18, 19]. It stresses the need to incorporate the patterned way by which the African thinks, behaves, and expresses feelings about reality into the total life of the university [20]. Far from hostility towards the Western worldview, there should be a conscious and concerted effort of re-modeling higher education in Africa such that the goal, content, method, research, and administration converge to produce graduates who recognize the needs and values of the continent [21]. Essentially, tertiary institutions in Africa will achieve this aim if the graduates they churn out display a sense of Africa's commonalities, affirm Africa's culture, tradition and value systems, and foster a comprehension of the African consciousness in a bid to blend both western and African methodologies of resolving the challenges of the African people [5, 22].

An appraisal of tertiary institutions in Africa in terms of Africanization only deepens the doubt of the relevance of these institutions. For instance, research conducted in Kenya revealed that graduates from higher institutions were only strangers to the socio-economic development needs of the country [23]. A similar observation can be made across the continent as most African universities employ content and delivery methods that are simply out of tune with the developmental needs of African society or as noted by Amponsah et al. [5] are skewed towards western philosophies of education. As such, graduates from these tertiary institutions "are not active, creative participants in the economy" of their countries [24]. The logical conclusion from the disparity between African graduates and their subsequent irrelevance in Africa's socio-economic struggles would seem to suggest that content and methodologies used in educating these graduates are foreign to the demands of their developmental context [25]. In this regard, higher education institutions in Africa have, to a large extent, failed to contribute to the improvement of the quality of life of the African community [26]. As a result, most tertiary graduates in Africa are marginalized by society. This is obviously a defect in the efforts to educate people to the highest level and this needs to be fixed to reverse the negative assertions on higher education institutions.

3. Challenges of Africa's higher education institutions

The doubt on the relevance and impact of higher education in Africa has been sustained by certain pillars. A common proverb goes like "there is no smoke without fire." This section is therefore dedicated to establishing some key challenges African higher education institutions continue to battle among which are the commercialization of teaching and learning, scarcity of qualified faculty, inadequate resources for research, and ineffective governance of higher education institutions. First of

all, the increasing demand for higher education in Africa explains the escalation of private tertiary education institutions on the continent. It is recorded that private universities grew from 35 in 1969 to 972 in 2015. As a consequence, higher education in Africa has become a privileged right instead of a public good. This implies a *for-profit drive* rather than a *nonprofit drive*. Like other neoliberal institutions, widening the profit margins of the entity is a primary interest of its owners. In this regard, management of higher education institutions in Africa engages faculty, students, content, teaching and administrative methodologies that contribute to the economic interest of owners. Such *for-profit* motif has even infected public higher education institutions. African governments are reducing state funding of public universities in favor of commercializing policies such as "cost-sharing" [27]. The effect is that economic interest instead of the need to produce a refined workforce for society determines the standard of operations in most African universities.

More so as higher education in Africa expands, the need for qualified faculty becomes apparent but that has mostly been the case. For example, Kenya's Commission for University Education revealed that only 34% out of 18,005 faculties from the nation's 74 universities and colleges possessed doctorate degrees [14]. This reality implies that higher education institutions in Africa will have to rely on faculty without the requisite qualifications or part-time lecturers for students' engagement. Since these part-time lecturers have a primary commitment in their substantive institutions, their services in these part-time institutions are limited both in terms of contact times and quality of contents. Lecturing in multiple institutions most likely lead to limited research output. Available records indicate that Africa produced 2.1% of the world's academic publication compared with 33.1% by Asia and 32.9% by Europe. This results in the production of half-baked graduates for the African corporate society. No wonder the endless cycle of the mismatch between graduates from African higher institutions and African industries continue to exist and has been put on autopilot until something is done to salvage the situation.

Also, the lack of funding for research activities in African higher institutions is becoming pronounced [27]. Well-resourced libraries, Information-Technology facilities, and research-experienced faculty are lacking in most African higher institutions. For this cause, most Africa higher institutions fall short of being described as research universities. Not only are the research outputs low, but they are also regarded as substandard and hardly find their way to top-notch publication outlets. Global statistics on internationally collaborated publications in 2014 showed 90% of scholarly publications by African faculties were done in partnership with western countries. Most of the research outputs have more significance to the western partners than the African counterparts. This is indicative that such African scholars are insignificant to socio-economic issues of their immediate milieu [28]. By inference, even the majority of the research carried out by African scholars may never result in solving the problems of the continent.

To a large extent, the governance of Africa's higher institutions leaves much to be desired. Corporatization of African higher institutions has included individuals who are oblivious of leadership skills in academia. Governing councils of universities in Africa direct the affairs of the universities without recourse to the autonomy and freedom of the academic community. In some parts of Africa, the attitude of government regulatory bodies has added to the decline of quality in the operations of Africa's universities. Instead of adopting the collaborative approach to building these universities, these regulatory bodies have taken an interventionist stance. Through this approach, they prescribe content and methods that are mostly inconsistent with the aims of the general academic community under their jurisdiction. In some circumstances, these regulatory bodies assume a bias stance against private

universities. Such internal and external pressures rob African university communities of the vitality that academic freedom and autonomy brings.

4. Prospects of higher education in Africa

The presence of these challenges and their consequent hindrance to the optimal performance of the task of higher education in Africa is in itself a case for the relevance of these institutions in the twenty-first century. To have maximum impact on the African continent, it is suggested that the higher education system in Africa revisualizes its fundamental mandate and usefulness in the twenty-first century society. To this end, research collaborations across disciplines and higher education institutions, improvement in irregular/nontraditional modes of teaching and learning, utilization of student-based learning models, and restructuring the governance of higher education institutions will aid universities in Africa to contribute significantly to the comprehensive development of the continent. Such revisioning is necessary given the increasing demand for higher education in Africa [10].

Secondly, research collaborations across disciplines and higher education institutions will equip African faculties for significant research undertaking. Through such partnerships, African higher institutions will pull resources together for academic research. In working together, inexperienced-researchers will acquire skills from their experienced counterparts and skills learned will sharpen their curriculum planning, delivery, and research [29]. Also, the quest to conduct research that is relevant to the socio-economic and developmental needs of African society should be the top priority of African higher institutions. Such studies have the potential of attracting industries in Africa to invest in the research programs of the institutions. Through meaningful collaborations, such higher institutions will not only heighten their impact in the local context, but they would also create an impact on the global front.

Developing and maintaining irregular or nontraditional modes of learning is one sure way for higher education in Africa to respond to the increasing demand for quality and accessible higher education [30]. Otherwise known as innovative/modern learning methods, nontraditional learning modes refer to learning strategies that enable communication between learners and their faculties/institutions without the need to be physically present in the institution of learning. These strategies are generally self-directed and interactive. They can effectively engage the learner through technology-based methods such as virtual study environments (e.g., webinars), interactive interfaces, and blended techniques (use of videos and computers for teaching and learning). In the twenty-first century, harnessing the convenience, accessibility, self-paced and self-directed nontraditional learning modes of learning within the context of affordability can boost the quest of African higher institutions to remain relevant to the changing times.

Additionally, other modes of learning such as distance education, sandwich, weekend schools, and cohort learning methods could bring the benefits of a robust professional connection and single purpose experiences in the life of the learner. By these means, the missing link between higher education institutions and the requirements of industries in Africa could be supplied. In using these modes of learning, it is expected that regulatory bodies will objectively ensure quality in performing the task of education. In some places in Africa, these twenty-first century modes of learning have been rejected because they are always inferior to traditional styles of learning. Instead of showing hostility towards these learning modes, regulatory bodies should acquire the expertise needed to understand various technologies that drive these methods in their bid to ensure quality content, delivery, and assessment.

This requires a shift from teaching methods that emphasizes a teacher-mediated-classroom learning to more dynamic models of learning relevant to the comprehensive task of higher education in the twenty-first century. Such dynamic pedagogies utilize formal, nonformal, and informal strategies to engage students in analytical learning contexts that aim at making learning both a social construct and activity [31]. These dynamic pedagogies are drawn from several theories on the methods of teaching. The behaviorist learning approach is one of such models. This approach sees the learning process as a means of sharpening specific and general ways individuals respond to environmental conditions [32]. A mastery of these responses may equip learners with skills that may enhance their productivity in the society.

The constructivist paradigm may also be helpful in this regard. Shifting attention from the passive recipients of teacher-mediated information, constructivist learning engages learners in active learning contexts that use both the past and current situation of the learner as bases for the generation of functional ideas [33]. Its usage of collaborative learning ensures learners acquire knowledge from both their personal life and the life of their peers and/or colleagues. Situated learning is closely knitted with this paradigm. It distinctively uses the process of social interaction as the locus of learning [34]. Through field learning and interaction with experts of relevant professions, learners acquire firsthand information that aids personal reflections of subjects of study.

Same techniques may be observed in pedagogies that uses the problem-based learning approach. In this paradigm, learners are encouraged to resolve career-related dilemmas in a structured manner [35]. These problems may be real or hypothetical. However, knowledge gained from such exercises is likely to enhance learners' attitude of problem identification and resolution in real life situations. This also appears to be the goal of the lifelong learning model. Lifelong learning is predicated on the notion that learning is a process that continues through one's life, either unconsciously or consciously [36, 37]. In this regard, lifelong learning equips learners with the skills to master the content of what they learn as they progressively encounter the changing seasons of life.

African higher institutions cannot be relevant to their immediate society if the content, method of delivery, and assessment are irrelevant to the students. This calls for the utilization of student-based learning models in African higher institutions. Learning plans, content, and methods that place premium on the cognition, behavior, and affective traits of learners achieve "effective learning, self-efficacy, self-motivation, ability to plan, and seek help when necessary and be able to reflect on past learning experiences to look to the future" [27]. Such learning methods are capable of creating the environment necessary for students to apply, create, and evaluate the knowledge they obtained from the study [38]. By mastering their environment, students leave these institutions of higher learning with the skills needed to effectively transfer knowledge from the school setting to the wider society for meaningful output. African higher institutions will be re-imagined as the producers of the workforce necessary to drive the socio-economic development of the continent. The optimal performance of graduates from African higher institutions will call attention to the impact and relevance of these institutions in Africa.

Lastly, restructuring the governance of higher education institutions in Africa will be a step in the right direction. African higher institutions need administrative and finance teams who understand what it means to perform the task of teaching. These teams will partner academic communities to use their autonomy and freedom for effective teaching and learning. A conscious effort should be made to form institutional Councils with a membership that possesses the necessary capacities to understand the interplay of innovation, science, and technology, on the one hand, and strategic planning of higher education institutions, on the other side. Also,

governmental regulatory bodies must collaborate the efforts of African higher institutions, whether private or public, in ensuring that the institutions meet both the local and international standards of teaching. Together, the internal and external control of African higher institutions will solidify their existence as indispensable entities in the pursuit of the socio-economic developmental goals of the African continent and its people.

5. Conclusion

The gap between higher education in Africa and the socio-economic development of Africa has led to doubts on the relevance and impact of higher education institutions in Africa. Through the philosophical approach of methodic doubt, the core objectives for establishing these institutions were questioned. The mismatch between knowledge acquired from the higher education institutions and the soft skills required by the society to positively drive its quest towards socio-economic developmental goals in the African society sustains this doubt. Also, failure to satisfactorily reconstruct the African identity in the face of trends in the twenty-first century casts shadows on the significance of higher education institutions in Africa. Other factors such as the commercialization of higher education in Africa, the shortage of qualified faculty, inadequate or nonexistent funding, and corporatization of the governance systems of higher education institutions have crystallized the perception of nonperformance of the higher education institutions in the African society.

Despite the gloomy portrait of the relevance and impact of higher education in Africa, this chapter established that higher education is significant to the societal quest of resolving the socio-economic developmental challenges that continue to beset the African continent in the twenty-first century. Research collaborations across disciplines and higher education institutions, quality enhancement of nontraditional learning modes, utilization of student-based learning methods, and a restructured governance system of higher education institutions will enhance the relevance and impact of higher education in Africa. To this end, the system of higher education must consciously incorporate functional policies that will sustain cohesive teaching, learning, and research communities, funding and financial management, and improved governance of higher institutions in Africa.

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Author details

Dei Daniel[1], Osei-Bonsu Robert[2] and Amponsah Samuel[3]*

1 School of Graduate Studies, Valley View University, Ghana

2 Valley View University, Ghana

3 Department of Adult Education and Human Resource Studies, University of Ghana, Ghana

*Address all correspondence to: samponsah@ug.edu.gh

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Chapter 4

Approach to Pedagogy and Scenarios Poor People Face in the Pursuit of Basic and Higher Education

Charles Enock Mulimba Ruyembe

Abstract

This chapter addresses some key issues related to pedagogical approaches and scenarios marginalised groups face in the pursuit of basic and higher education in African countries. Based on a case study carried out in Tanzania and South Africa, this chapter explores debates within the theory and practice of education and teaching environment, and elaborates what the notion pedagogy encompasses in the act of teaching and learning, inequality systems linked to opportunities offered by the new Information Technology, lack of quality teachers and infrastructure all focused to poor people entering the labour market. This chapter considers how pedagogical challenges can be diminished and overcome the growing knowledge and skills shortages. Finally, it offers recommendations towards turning both pedagogy and pedagogical challenges into a success story focused on investing in human capital for the poor in Africa.

Keywords: pedagogy, unequal systems, Information Technology, human capital

1. Introduction

Pedagogy is an increasingly important component of education now regarded as part and parcel of an academic discipline. Hence, the notion in this book chapter refers to a study of how knowledge and skills are exchanged in an educational environment. The action puts into consideration the 'interactions between teachers, students, and the learning environment and learning tasks' [1]. It also incorporates how teachers and students relate together and how the instructional approaches are employed in differentiated learning tasks and environment [2]. Due to recent developments in the educational context, education experts have heightened interest in examining pedagogy as an academic discipline and how the entire process influences the interactions and growth of learners during learning and thereafter. However, I argue that a major challenge with all such initiatives remains to be the scenario poor people face in the pursuit of their basic and higher education, respectively. In African countries, many poor populations due to pedagogical challenges are left behind simply because of their countries education policies do lack systematic planning and training or passionate and committed teachers thinking beyond existing pedagogical approaches, with focus to ensuring effective pedagogy that

occurs in the teaching environment aimed at preparing learners to the real-world learning relevance [3]. As Abrams [4] contends, policy makers, schools and teachers have largely assumed that schools were the key to ensuring young people got the best possible start, yet for many children, the path to failure began well before their first day to school [4, 5].

Now, what does the notion pedagogy encompass in the teaching and learning environment? This is a complex issue and hard to account for due to the fact that pedagogies vary to a great extent due to social, political, historical, duration or time and international perspectives from which they do emerge [3, 6]. Notwithstanding, far too little attention has been paid to the complex nature of pedagogy challenges facing teachers on the African continent. In fact, the case goes far beyond the pedagogical approaches employed during the teaching and learning exercise to an extent of experiencing some teachers' incompetence in their academic and teaching profession, and this result to perform their tasks below standard as it is going to be clarified in the next section. Therefore, many school children or students are badly taught [4], and the action draws a weak foundation for a child's learning [5]. Put another way, pedagogy is extended to the teachers' understanding of their role, the teaching profession and knowing how children most effectively learn, and most importantly, how teachers have to productively engage in the teaching exercise. Shulman [7] argues that in order to advance teacher reform, it is essential to develop 'codified representations of the practical pedagogical wisdom of able teachers' [7].

Numerous studies have attempted to explain about approaches to pedagogy and basic strategies to eliminate pedagogical challenges in the teaching and learning environment. For example, in [8–11], it argue that the best approach to teaching is the one based on the assumption that students learn best when they actively engage in the curriculum and when their interests forms the foundation for the curriculum's construction. Furthermore, the incorporation of innovation as a new way of applying ideas and the flow of technology and information in pedagogy has to be employed as a way of describing or employing *arts education* (education in arts or education through arts), see Bamford [12], as a way of enhancing learners' creativity and critical thinking capacity. In clarification, 'education in art' [12] implies teaching pupils or rather students for the practice and principles of different art disciplines, with a focus on stimulating their learning, critical thinking and problem-solving ability. At the same time, while enabling learners to construct their own cultural identities, 'education through art' [12] informs art as a vehicle for learning other subject contents and teaching other general educational outcomes [12–14]. Indeed, in the drastically changing technology and global competition for knowledge and skills development, pedagogy and pedagogical approaches must incorporate new ways of learning, the latest information and skills relevant to learner's survival in the real world. However, the crucial point to make here is about approaches to pedagogy and strategies to eliminate pedagogical challenges in the African context. My summative explanation for the pedagogical challenges in African countries is as follows: firstly, *the teaching and teacher education model in the African context* must focus on preparing teachers to work with students or learners from diverse cultural backgrounds [15]. Secondly, poor pedagogy or outdated teacher education and *teacher's ability or passion* (as an individual) to adapt teaching profession strategies or practices have let down young people in the pursuit of attaining quality education. Thirdly, goals or main objectives of education policy and the quality and quantity challenges facing African countries including challenges that were triggered with the implementation of, for example, an 'Education for All' (EFA) agenda have contributed to a steady deterioration of education and fuelling pedagogical challenges in Tanzania like in many developing countries since the late 1980s to present [16, 17]. Fourthly, lack of appropriate and adequate

learning resources and infrastructure and external factors is in relation to the teaching profession. Fifthly, there are strategic ways related to how to meet students' needs as opposed to learner-centred theories of learning as it is believed that a learner possesses some qualities, potentials and resources embodied in a person whichstand as a portion of economic value of that particular person in its totality [18]. These resources, qualities and potentials sometimes regarded as human capital embodied in a person can be realised and invested through education and training, or interactions between teachers and students within the learning environment and learning tasks. Indeed, the pedagogy and its forms can motivate learners to meet their dreams in life, and can help in designing, paving way and strengthening of career pathways for students and overcoming the growing need of skills in Africa, likewise in other developing countries.

In that context, the current book chapter has been organised in the following ways: firstly, it gives a brief overview on approach to pedagogy, and what the notion pedagogy encompasses in the teaching and learning context; secondly, it reviews scenarios poor people face in observing their right to attainment of basic and higher education on the African continent (reference is made to a case study carried out in Tanzania and South Africa); thirdly, this book chapter discusses on infrastructure, learning resources and a pedagogy of teacher education in Africa; fourthly, it discusses pedagogy and inequality systems linked to new Information Technology (IT) opportunities in Africa; fifthly, the chapter identifies the marginalised population, their learning experiences and labour market challenges; and sixthly, it informs on the growing need of knowledge and skills and puts forth a need to invest in human capital. This chapter draws a conclusion by analysing some basic answers related to key research questions on a case study carried out in Tanzania and South Africa and puts forward some recommendations. In brief, this book chapter assesses how effective pedagogy as a broad method and practice within the teaching and learning environment can be characterised to real-world learning, and how pedagogical challenges can be eliminated so as to overcome the growing knowledge and skills shortages in Africa. Finally, the chapter gives recommendations towards turning both pedagogy and pedagogical challenges into a success story focused on investing in human capital with a vision to meet poor people's needs academically, socially, economically, culturally and emotionally.

2. Poor people in the pursuit of basic and higher education

Despite a fact that the right to education is a global issue and does not allow any room for exclusion or discrimination, many marginalised populations in African countries face diverse challenges. Scenarios poor people face in the pursuit of basic and higher education in African countries can never be isolated from challenges to effective interactions between teachers, students and the learning environment.

Prior studies have noted some key stumbling blocks poor people face towards modern education attainment in Tanzania and South Africa like in many African countries. These include low school enrolment and high dropout rates due to poverty, distance from school, and cultural and geographical barriers which in totality contribute to low academic achievement [19]. Unwanted pregnancies of teenage students delineate as one of the prevailing issues, which has left many primary and secondary school going students without relevant skills to thrive in society [5, 20, 21]. The case of HIV/AIDs and sexual abuse in young people is high due to poverty. Nevertheless, it can be argued that pedagogy in both basic and higher educational context (in African countries) has rarely been given room to prepare learners for a more connected, more technological future with a focus of helping them to gain critical life

skills, thus making education improves learner's transition from birth, the world they live in, and from school to work in a short term [13, 22]. Other challenges as outlined before, it include the lack of adequate resources, infrastructure and active pedagogical approaches that can be used as tools to enable learners to realise their potentials and develop their capacities [5, 23].

Building on the principle of 'leaving no one behind' [24], the United Nations General Assembly in September 2015 adopted the 2030 Agenda for sustainable development that includes 17 Sustainable Development Goals. Envision 2030 (SDGs), goal number 4 on 'Quality Education' argues for ensuring inclusive and equitable quality education that promotes life-long learning opportunities for all [24]. However, research reports show that making young people in poor countries to learn new information and skills that can sustain their needs in work and life remains to be a big challenge [14], and what happens is simply recruiting learners on passing examinations 'exam treadmill' until the day they exist from the education system [25]. Incidentally, many marginalised learners on their way towards attaining basic and higher education remain to be victims of external anti-social behaviour. These include: teenage pregnancies for female students; use of marijuana; homelessness; HIV/AIDs victims; orphans; high dropout rates; and those who lag behind others in terms of academic achievement [26]. All these outside forces in the learning environment paint the real lives of many poor young people on the African continent and, unfortunately, lead many of them to failure in education, work and life. As His Excellency, the late First President of Tanzania Mwalimu Nyerere said:

> *'...Tanzania cannot be created if some people are very highly educated and others are completely illiterate. The illiterate ones will never be able to play their full part in the development of our country or of themselves, and they will always be in danger of being exploited by the great knowledge of others. Therefore, we should plan to overcome the existing high level of illiteracy' [27].*

In interpreting the above statement, study reports show that the proportion of illiterate women is increasing in Sub-Saharan Africa and in countries such as India and China. Hence, this is a stumbling block towards sustainable development [13]. Based on the situation, Baregu [28] and Twaweza [29] both argue for the worrying trends of education and pedagogy challenges in Tanzania by revealing that there is now a rising number of not only women but also young people completing both primary and secondary school education without the ability to read, write and have at least basic arithmetic skills. Commenting on education in South Africa, Carroll [30] argues that illiteracy rates to women are on the decline. However, the situation does not mean to have a satisfactory education system, an equitable employment environment and an adequate primary and secondary education in place. As a matter of fact, the scenario of education system in many African countries has been influenced by systems established in foreign and rich countries. Thus, in adopting such systems, difficulties and confusions have erupted in the use and applications, with specific in pedagogy and its forms [31]. The extracts from the respondents' comments and unit of analysis illustrate the above stipulated findings clearly:

> *-I say, the current education system in Tanzania must change and include theory and practical. I mean work-based learning from primary schools to University level (...) arts education must be given priority, and be examinable so as to help in promoting youth employment (interview, respondent 4: in Mwanza Tanzania).*

> *-I see the system encouraging learners to cram what teachers say! aimed to pass examinations! (...) the teaching and learning system has very much adopted the 'banking concept of education' as mentioned by Paul Freire! This is a challenge! My opinion is that education must stimulate talents/ activate and nurture the creative capital embedded in students (Interview, respondent 2: in Dar-Es-Salaam Tanzania).*

> *-Yeah, my feeling is that our challenge lies at the education system. This does not nurture creative talents of poor young people with a vision for their future sustainable lives (Focus group 3: in Bagamoyo, Tanzania).*

The above extracts identify a strong relationship between poor people and the pursuit of their attainment of basic and higher education. However, a change in the basic and higher education system, including a thorough elimination of outside forces or obstacles in the teaching and learning environment, was a feature of many respondents' views.

2.1 Infrastructure, learning resources and pedagogy of teacher education

Lack of adequate and conducive teaching and learning environment (infrastructure) includes buildings or enough classrooms, desks, libraries, relevant and enough books and laboratories for science subjects which are just a few examples of challenges observed in many African education system. As a result, Africa has in place a vast number of children being badly taught or utterly untaught [32]. The implication is that there are too few schools and too many bad schools [33]. To illustrate, this study produced results that corroborate the findings of a great deal of previous work in the field [14] as follows:

> *-Yeah! I say, we still have a long way to go! The challenges in our education lies at poor infrastructure, lack of adequate learning resources and competent teachers. Hence, a change of the current education policy is essential for the positive impact (Focus group 2: in Mwanza, Tanzania).*

> *-Aaa (.) our education system lacks the development of creativity and innovation within the learning environment. Education must go with practice not only theory (...) and other subjects as the learners go must be infused into arts education with no exception of social, cultural and economic issues (Focus group 1: Lindi, Tanzania).*

The statements above are in sympathy with those of [15–17] focused on the interactions between a teacher, as a guide who must enable learner's academic growth, and a learner, as a person who possesses some level of qualities and potentials which can be realised. Finally, there is a need of a conducive learning environment and appropriate learning tasks. Based on the interpretation above, this section relatively refers to a case study of Gauteng's province (in South Africa) education system. The case study of Gauteng's education system provides valuable lessons based on two students in the same schooling system, in the same country and with the same curriculum but from schools with different learning resources. The end results were that one student from a well-resourced school passed with flying colours, while the other one from a poorly resourced school failed. Hence, this is what we termed as 'unequal education system' or 'levels of inequality' [34]. However, since 1994, Gauteng education department has been launched several

interventions, so as to eliminate these levels of inequality, including an equal distribution of teaching and learning resources. The levels of inequality in pedagogy and its forms well identified above depict the real situation in many African countries education systems. The two distinctive outcomes as stipulated are compared to a four-legged table made up of unequal-sized legs. Admittedly, the table will not stand in its up-right position instead it will topple [35]. The implication provides another valuable lesson related to the effects that a learner can experience in his future job prospects.

In the same manner, pedagogical challenges and implications of having too few schools and too many bad schools have been provided by a case study carried out in Tanzania. The study identifies short-falls and provides meaningful lessons related to the Tanzania's education system. These include, but are not restricted to, the lack of enough teachers in schools and inability to recruit quality or competent teachers and its effects to learners and the entire education outcomes. To illustrate, the incompetence of some teachers is now widely seen as a general gap in teacher education. The previous study reports that there is a weak foundation for children's learning and mastering of both English and Kiswahili languages in Tanzania. Hence, the main feature of the Tanzania's education system is that it is bilingual (English and Kiswahili). In examining children's competence in reading Kiswahili and English languages, the research found that by standard seven, five in 10 students leaving school have not acquired a basic English reading skill, which is equivalent to 53% of standard seven students. One out of 10 standard seven pupils was unable to read a Kiswahili language paragraph [29].

Tanzania like many African countries is experiencing many of its young people lacking literacy skills. UNESCO [13] reports that across the world, there are approximately 250 million children who cannot read, write and count well, and 200 million young people leave schools without adequate skills they need to thrive. Literacy includes the learner's capacity to read, write and count, and this is a vital aspect to the broader achievement of his academic, social and economic impact. Learners who fail to gain literacy skills at their earlier stages of learning are likely to fail in catching-up studies at latter stages and are significantly more likely to fail in their future lives. Unfortunately, in Tanzania, some teachers' incompetence has resulted in some defects to learners in phonological awareness (in both English and Kiswahili languages), how letters combinations correspond to speech sounds. I argue that the lack of having in place a good number of quality and qualified Kiswahili and English language teachers is due to the missing foundation in teacher education. Therefore, to eliminate the spoken and written Kiswahili language structure challenges to children, there is a need of improving teacher education, pedagogical approaches and teacher's knowledge, skills and ability to understand, use and appreciate various forms of communication so as to remove the failure to communicate fluently.

I argue that teachers cannot naturally acquire the outlined kind of expertise in Kiswahili language structure that is required of them for remediating and preventing literacy problems, unless we provide them with necessary training. The case study conducted in Tanzania [14] emphasises that having in place teachers who have adequate knowledge in sound-symbol correspondences in spoken and written Kiswahili language and appropriate methods will help to eliminate defects to learners in, for example, Kiswahili words such as 'Habari' (news) which most utter and write it as 'abari' (omitting H), and 'Hakuna' (nothing) many say 'akuna'. The word 'Rafiki' (friend) utter and write it as 'Lafiki' use 'L' instead of 'R' and in 'Karibu' (welcome), they say 'Kalibu'. Likewise, in a word 'dharau' (disrespect), some omit 'dh' and say 'Zarau'. As said previously, a vast number of children are badly taught [4]. Therefore, enhancing teacher's phonological awareness

and making them be well versed on how letter combinations correspond to speech sounds, and building their capacity in Kiswahili language structure will at last help children to enhance their capability in creative thinking and understanding challenging concepts more easily.

2.2 Pedagogy and inequality systems linked to new Information Technology opportunities

In giving answers related to Question number 4, '*To what extent has the education policy and system inspired students to discover and improve their human capital in Tanzania/South Africa?*' Most respondents expressed their feelings as follows:

> *-Aaaa (.) to me I can say, Pedagogy and pedagogical approaches in the learning environment most lack the inclusion of new IT opportunities focused on nurturing individual potentials, development of creativity and innovation so as to meet the 21st technological advancement (Focus group no 1: Dodoma Tanzania).*
>
> *-Poverty in our African countries contributes to the out-dated pedagogies we do experience in many of our rural and urban public schools. Hence, both teachers and students are never exposed to opportunities offered by the new Information Technology aimed at making them experience the real-world learning relevancy (Focus group 2: Mwanza Tanzania).*
>
> *-Well, I see the education system with unequal distribution of resources. Unfortunately, that can never inspire students to discover and improve their skills and knowledge. Therefore, we can-not match with the drastic 21st Century technological development (Interview, respondent 7: in Pretoria South Africa).*

Based on the statements above, an implication of this is the possibility that many African countries are more likely not to attain 'Envision 2030' or SDGs numbers 4 and 10. As well stipulated, Goal 4 on quality education seeks to ensure inclusive and equitable quality education and promote life-long learning opportunities for all, while Goal 10 insists on ensuring of reduced in-equality within and among countries [24].

Digital literacy or new Information Technology (IT) offers opportunities and enhances pedagogy, literacy and skills in the modern education system. The use of new solution to existing challenges so as to benefit a good number of people including the poor and marginalised population is what can be characterised as innovation. The world is changing quickly, and the uses of new Information Technology do prepare students for a more connected interaction within the learning environment and teaching profession. However, I argue that an added value to effective pedagogy in the new learning environment can be observed by, for example, appropriate use of computers, Web 2.0 and use of cyber space, virtual exhibits, study tours, digital networking, video games and digital story telling that captures the elements of real-world learning. Such instructional interventions can make students to learn and understand challenging concepts easily, have the ability to enhance learner's awareness and can support students to reach their full potential, academically, socially and emotionally as well.

Indeed, technology and digital revolution have opened a new window for teachers as educators to go digital. However, the current study conducted in Tanzania and South Africa rationalises that using new Information Technology opportunities in pedagogy has brought about some education excellence inequalities between well-resourced schools mainly in urban areas as opposed to under-resourced schools

[34], usually found in rural settings in Africa. In clarification, passionate and committed teachers can enhance the capacity and status of the teaching profession by giving room to children to construct their own knowledge, needs and thinking skills [5]. Likewise, Pohl [36] contends that literacy, learning and employment need to get people to think creatively in the arts, think hypothetically in mathematics and think literally in social science. In that context, teachers stand as facilitators who guide learners throughout the entire process while providing them with real-world experiences beyond the classroom or training environment. The inequality systems linked to new Information Technology opportunities corroborate the findings of a case study based on three different learners from Gauteng Province in South Africa, namely 'Thandi, Sipho and Hennie'. The scenario was as follows:

> *'Thandi has passed matriculation with flying colours. She has been accepted at the University of Cape Town but has no laptop. At least is tech-savvy... Sipho on the other hand is from a rural school and has performed well but is anxious about his course because it requires prior knowledge of information communication technology (ICT)...Hennie has no anxieties. He has it all' [34].*

The extract above paints out the inequalities in the teaching and learning environment which were brought about by poverty and the lack of exposure to new Information Technology (IT) opportunities specifically in African countries context. It highlights technological advancement and challenges faced by both teachers and learners in a process of transformation towards experiencing a generation of innovators in a drastic changing world. This chapter argues that the new Information Technology opportunity challenges teachers face in the context of pedagogy have neglected both teachers and learners in basic and higher education to explore and navigate on their own, meet their needs, and reach their full potential professionally, academically, socially and emotionally.

2.3 Marginalised populations, learning experiences and labour market challenges

One major challenge that has dominated the primary educational paradigm in Tanzania and it has effects to marginalised population's learning experiences is a focus on what students know, rather than how they use the information in the real-world settings [37]. Hence, the most valuable feature in the learners' expertise is how learners can apply what they have learnt in a new and creative way. As Sweeney [38] contends:

> *'real-world learning connects students to career pathways, it empowers them to be effective decision makers, designers, inventors and communicators...it allows them to see and know how a chemical formula would assist him in his post-secondary life...role of chemistry in farming or trigonometry and geometry in the construction trades...and how are important to their future career and to their communities... if we want to prepare all our students for the careers of their future, the educators, community leaders and local companies must come together to help students experience academic concepts in culturally relevant, real-world ways' [38].*

Giving an overview on the labour market challenges to marginalised populations, the International Labour Organisation (ILO) report indicates that young people in many of the developing countries within the Sub-Saharan Africa region face labour market challenges [39]. Findings from the Integrated Labour Force Survey (ILFS) show that new entrants within the labour market in Tanzania range

from 800,000 to 1 million annually and compete for only 40,000 existing job opportunities in the formal sector [40]. As Brown [41] suggests young people must concentrate on freelancing and self-employment or 'boundary-less careers' [42]. Undoubtedly, these are the most frequent types of employment or businesses in the arts, cultural and creative industries sector. A large and growing body of literature reports many disadvantaged young people in African rural and urban areas (both out of school or drop-outs at basic and higher level of education) leave schools without relevant knowledge and skills needed for them to thrive in their societies. The main challenges learners encounter include but are not restricted to poverty, quality of education, political will linked to policy, decision and law makers priorities and lack of guidance from birth (parents, guardians and families) to school, up to their time of entering the labour market [13].

Strong evidence of how real-wold learning connects students to career pathways was found when participants were giving answers related to research question 1: '*What are your feelings and comments on the current education system in relation to the growing number of primary and secondary school leavers drifting from rural to urban areas in search of jobs in Tanzania?*' Many respondents expressed their feelings as follows:

> *-Yeah, it's true there is the drifting of these young people from rural to urban areas in search of jobs. I see that as a challenge related to our education system from primary level to secondary schools that-arts subjects are not taught and examinable (Interview, respondent 2: in Dodoma Tanzania).*
>
> *-My feeling is that the education system (in Tanzania) is the one we inherited from the British... and still has the western education ideology or elements. Thus, education leaders having the white-collar job mentality (...) arts education has never been one aspect within their priority circuit. In that regard, good actors (students) have become politicians; good painters have become motor mechanics and the like! (Interview, respondent 3: In Dar-es-salaam).*
>
> *-I remember previously, the late Mwalimu Nyerere (first President of Tanzania) introduced education for self-reliance. I think it is high time that has to be re-introduced. Furthermore, Vocational Schools should be strengthened so as to introduce entrepreneurship skills to learners, thus, help young people in nurturing their talents and get self-employed. Finally, deliberate initiatives have to be taken by the Ministry of Education in strengthening arts education in schools from primary level to the University (overhaul the whole system) (Interview, respondent 4: in Dar-es-salaam).*

Without ignoring debates hidden in the statements above, this book chapter has provided results that do suggest pedagogy and pedagogical challenges in the teaching and learning environment. The chapter has identified key challenges faced by marginalised students in the pursuit of attainment of basic and higher education in Tanzania and South Africa (as a case study) and corroborates the findings of a great deal of other previous works in the field [11, 14, 34, 35].

3. Conclusions

This chapter has devoted itself to assessing and discussing various themes related to pedagogy and pedagogical challenges poor people face in the pursuit of basic and higher education. For the outlined purpose, this book chapter has

discussed themes related to the term and notion 'pedagogy' encompasses in a range of factors including intelligence, gender and culture. It has reviewed different scenarios marginalised people face on their way of attaining basic and higher education on the African continent with vivid examples from a case study carried out in Tanzania and South Africa. Challenges related to infrastructure in the teaching and learning environment, lack of adequate learning resources and the essence of recruiting quality teachers within the teaching profession have been outlined. Again, this chapter has discussed pedagogy and inequality systems linked to new Information Technology opportunities within African countries. Hence, the thematic area insisted on teachers or schools to prepare learners for a more connected and technological future [22] so as to succeed in their future lives. Finally, it has identified the marginalised population and their learning experiences as opposed to the labour market challenges. The section has informed on the growing need of knowledge and skills and referred to a need of investing in human capital and social relation. As a matter of fact, human capital and social relation can be regarded as carriers of knowledge that facilitate young people to learn new things, reinforce old ideas, solve problems progressively, make decisions, be creative and, finally, establish a next generation of innovators with a vast new range of opportunities [14, 43, 44].

In a summary form, the study findings mainly based on the case study carried out in Tanzania and South Africa suggest, firstly, African governments must invest heavily in their country's education systems. Education at its wide scope is an investment sector due to the fact that it deals with human capital [16] and, in every aspect, is 'as hard as building bridges and roads' [45]. Secondly, the study findings show that 'at an ultimate stage, competition among nations will be among education systems...for the most productive and richest countries will be those with the best education and training in place, and well implemented' see [46]. Thirdly, education and effective pedagogy at its broad spectrum must meet needs of poor and marginalised populations socially, economically, culturally and emotionally. Fourthly, African governments must work on key stumbling blocks to education success. These well-identified obstacles include but are not restricted to low school enrolment and high dropout rates, poverty, distance from school, pregnancies at tender age, pedagogical challenges that affect and make students to leave schools without relevant knowledge and skills to thrive in society.

The current study suggests that teaching and learning must connect students to real-world learning. In clarification, education and pedagogy must connect learners to their future career pathways. Finally, this book chapter suggests that African governments must revisit and re-work on the problem of having too few good schools and too many bad schools. This has resulted to a vast number of children being badly taught or utterly untaught [4] due to government's inability to recruit competent or quality and enough teachers to cater the need. Other related challenges to be put into consideration and practice for the success of pedagogy and the education system in the African settings include infrastructure challenges, lack of adequate teaching and learning resources and inequality systems linked to new Information Technology opportunities in schools.

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Author details

Charles Enock Mulimba Ruyembe
Karibu Cultural Contact (KCC), Dar-Es-Salaam, Tanzania

*Address all correspondence to: cruyembe@yahoo.com

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Chapter 5

Using the Research Tutorial as a Training Strategy for Tutor Professional Development in an Undergraduate Course

Duncan Mhakure

Abstract

This chapter is part of a larger research project that seeks to investigate sustainable ways of improving group-based tutoring in higher education courses. A growing body of research into teaching and learning in higher education acknowledges that higher education institutions are regarded as bastions of active teaching and learning that encourage students' deep learning and critical engagement. However, existing research also suggests that there is a lack of active participation by students during learning activities in tutorials; one of the reasons is the poor quality of the interactions between tutors and students during tutorials. Postgraduate students, who make up the majority of tutors, receive little formal training and lack sophisticated instructional skills on how to facilitate tutorials. By using an example, this chapter argues for the use of a research tutorial as a training strategy for tutor professional development (TPD) in an undergraduate Quantitative Literacy (QL) intervention course. The research methodology employed in this study is the lesson study. A research tutorial is a tutorial designed by both tutors and researchers that is used for TPD purposes. Suggestions for future research include focussing on how tutors notice, and attend to, the students' productive struggles during an undergraduate QL tutorial.

Keywords: peer tutoring, research tutorial, deep learning, cooperative learning, lesson study, students' productive struggles

1. Introduction

Tutoring in small groups to facilitate cooperative learning is not a new approach in higher education. While tutoring plays an important role in student learning, thus improving throughput and helping students to achieve their professional goals [1–3], the majority of the tutors who engage in tutoring do not receive any formal training [4–6]. This chapter, which is research-based, proposes the use of the research tutorial as a training strategy for TPD in higher education courses. The process of tutoring embodies broad features and characteristics, for instance: academic and educational dimensions; administrative issues—tracking students' performance; classroom practices—teaching of the discipline content; peer tutoring—as observed in many universities, among others. This chapter's focus is on the discourses of student-tutor classroom practices—in other words, what

are the interaction dynamics and mathematical discourses that can be observed in student-tutor interactions during tutoring. A South African higher education context is used as an example of this model of TPD. While this chapter is based in the South African higher education teaching and learning context, international readership, particularly individuals who deal with teaching and tutoring in higher education and/or other learning institutions, including schools, will also find the contents interesting. In other words, the target readership includes both South African and international teachers and lecturers. This chapter is composed of nine sections: *first*, a summary of the chapter—the abstract; *second*, an introduction to the chapter; *third*, the context of teaching and learning in higher education; *fourth*, the interdependence of cooperative learning and tutoring; *fifth*, the research tutorial framework; *sixth*, the operationalisation of a research tutorial; *seventh*, the conclusion; *eighth,* acknowledgements; *ninth,* conflict of interest*; tenth,* appendix: research tutorial—percentage change*;* and *last,* the references.

2. The context of teaching and learning in higher education

A growing body of research into teaching and learning in higher education acknowledges that higher education institutions are regarded as bastions of active teaching and learning that 'promote students' deep learning and critical engagement' ([2]; p. 64). However, existing research also suggests that there is a lack of active participation by students during learning activities in tutorials; one of the reasons for this is the poor quality of the interactions between tutors and students during tutorials [7, 8]. In the context of this chapter, and from a historical perspective, tutoring as a tradition has been in existence since the twelfth century, when the British schools used tutors in special pedagogical positions to assist in the academic development of individual students in schools and higher education institutions [9, 10]. In addition, tutoring was historically used in early European colleges and among the Bourgeois classes and royalty as a form of instruction within these institutions and/or classes [11, 12]. The Latin word *tutor* means 'defender, guardian', and is in turn derived from the Latin verb *tueri*, which means 'to look after, to observe, to guard' ([10], p. 184).

It is true that higher education globally is facing an increasing number of challenges due to the student body becoming more diverse in terms of age, 'ethno-cultural, socio-economic and even linguistic backgrounds' ([13], p. 118), motivation, learning needs, and students' preparedness, among others [14, 15]. In addition, higher education institutions are also faced with perennial under-funding, which is exacerbated by rapid technological advancement [14]. The South African higher education context is no different from that of other countries, particularly third world countries: institutions of higher learning are mandated to address other social challenges, such as the growing demands of accessibility and equity [16, 17], including issues of student retention and throughput, particularly among undergraduate students. Throughout the world, despite universities' efforts to retain students, only half of all students complete their studies in the regulation time [18, 19]. Comparing retention rates between countries is not an easy endeavour, because individual countries measure completion rates differently. For instance, according to [20, 21], the completion rates of the following countries were: Australia (23%), Denmark (24%), Japan (26%), and Ireland (21%); although these figures appear low, they were in fact some of the countries that experienced higher rates In the context of South African higher education, the completion rate in 2011 was 27%—meaning that only 27 out of every 100 students, on average, completed their studies within the regulation time. In other words, 27% of the students did not take an extra semester or year to complete their degree programme. In the United States

of America, studies show that more than 40% of the students who enrolled in 2007 failed to complete their degrees by 2013 [22]. There are many factors that contribute to the low rates of study completion and student retention in universities; these include, but are not limited to: predominant lecturing style of teaching in a large classroom with many students—this style does not encourage students' participation during learning; no monitoring of students' attendance as a pre-requisite for writing or passing the final examinations; and the fact that academic staff are inundated with duties other than teaching, such as grade revision and their own research studies [14]. In recent years, the use of podcasts to record lectures, though positive in many other ways, has contributed to students' lack of active participation in teaching and learning activities. Studies have also shown that contextual factors that hinder students' participation have to do with how institutions allocate resources to student development and learning opportunities that encourage student participation [23–25]. All the factors contributing to low completion and retention rates, in addition to causing high levels of frustration among students and academic staff, furthermore place a huge social and financial burden on the country's fiscus, particularly in countries with free education—such as Norway, and have a significant and negative effect on the quality of teaching and learning [26–28].

The teaching and learning space in higher education is complex and challenging. As already alluded to in this chapter, the greater diversity among higher education students from different linguistic and cultural backgrounds and the creation of learning environments where high levels of student engagement are prioritised, is adding to these difficulties [2, 24, 29]. Research suggests that the introduction of cooperative learning (CL) [30–32], through the tutoring of small groups, for instance, could assist in creating conducive learning environments, which would be better able to address students' lack of active participation and engagement [33, 34].

3. The interdependence of cooperative learning and tutoring

Understanding the interdependence between CL and tutoring is important in the context of this chapter. CL is defined as 'the instructional use of small groups so that students work together to maximise their own and each other's learning' ([35], p. 3). CL represents a shift from lecturing passive big groups of students to tutoring smaller groups, where a tutor is in charge of a small group. In CL, the instruction focusses, through the guidance of a tutor, on stimulating and encouraging student-student and student-tutor interactions during tutoring [35, 36]. These interactions promote a deeper conceptual understanding among students, and foster the development of higher order, social, and critical skills, which are valuable for the students' future life [37].

Student-tutor and student-student interactions discussed in this chapter take place during peer tutoring in the higher education context. In a general sense, peer tutoring entails individuals of the same group or social standing teaching each other, when one of the group members has more expertise or is more knowledgeable than the others [4, 38]. While in higher education peer tutoring is regarded as an integral part of academic development and support programs designed to assist at-risk students, defining the construct of peer tutoring is perceived to be complex, and at times contested [9, 12]. Variations of peer tutoring include: one-to-one tutoring, tutoring small groups—where a tutor oversees a small group of students, and online tutoring—which is used to support students studying through distance education, among others. In this chapter, peer tutoring embodies cross-age tutoring, where postgraduate students in quantitative disciplines assume the role of tutors to undergraduate students in a QL course, and where each tutor deals with

a small group of students [4, 39]. Hence, this chapter uses the word 'tutoring' to refer to peer tutoring of undergraduate students in small groups, with each group facilitated by a senior student/postgraduate student.

Recent lines of research on higher education teaching and learning have shown that institutionalised tutoring is regarded as one of the strategies of encouraging the active participation of students and fostering more proactive interventions that address students' deficits [9]. In addition, undergraduate students need more direct learning, such as provided during tutoring, to help them with assessing their own knowledge deficits [1]. Ideally, a tutor should address undergraduate knowledge deficits by fostering greater student engagement and participation in tutorials. Morano and Riccomini [40] assert that tutoring is one of the instructional strategies that can be used to address 'high order learning objectives including comprehension, application, and problem solving' (p. 104) that are strongly emphasised across all higher education disciplines. It should not be deduced, however, that this chapter is suggesting that tutoring is the only solution of all learning challenges in higher education. Having said that, my position is that tutoring, as a part of university teaching-learning approach can indeed improve the throughput and retention of students and help them to achieve their professional goals [3]. By means of the example in this chapter, I argue for the use of a research tutorial as an effective training strategy of tutor professional development (TPD) in an undergraduate Quantitative Literacy (QL) intervention course. To express it as a research question: How can a research lesson be used as a training strategy for TPD in an undergraduate course?

Higher education studies in many disciplines concur that tutors as facilitators for student learning should be trained through workshops and/or seminars to be equipped with the necessary didactical skills [41]. By collaborating with the relevant discipline's course convenors and/or coauthoring course materials, as part of tutor training, tutors can further develop familiarity with the instructional strategies that promote student learning [42]. Central to the debates on how tutoring improves students' active participation and engagement in learning activities is the efficacy of the tutor training program. Academic development programmes in which tutor training is a key feature tend to contribute more to students' success than do those without tutor training [9]. In other words, tutor training programmes enhance the facilitating of the tutorials, by providing opportunities for feedback and peer interactions that empower tutors to provide better learning experiences during tutorials [6, 43]. McFarlane [44] concurs and posits that 'tutoring in higher education from a tutor's perspective suggests that tutors lack training in tutoring and may lack clarity as to the purpose of the role' (p. 77). One of the key focuses of tutor training is how to transfer the knowledge, skills and behaviours acquired by tutors to real tutoring settings [45]. It is clear that the quality of tutors is one cause for the variations in student learning during tutorials, and that the quality of tutoring programmes directly influences the quality of tutors [46]. In accordance with [47], the word 'quality' in the context of tutoring programmes refers to 'both changes in the environment in which education [tutoring] takes place and the detachable gains in learners' [students'] knowledge, skills and values' (p. 13). Here the word detachable gains are gains that apply outside the tutorial, such as, self-regulation. Despite increase in tutor training programmes and their benefits in developing students' higher order cognitive skills, as already illustrated in this chapter, many more studies on tutor training are emerging [15, 45, 46].

4. The research tutorial framework

In this section, an alternative tutor training model is presented. The origins of this model are based on the construct of the lesson study framework and the notion of

the research lesson—both of which have been popularised in mathematics education, particularly in schools [48–50]. As a form of continuous professional development (CPD) for mathematics teachers, [50] asserts that a lesson study is an approach:

> *in which teachers [tutors and academics] work together to: formulate goals for student learning and long-term development; collaboratively plan a 'research lesson' [research tutorial] designed to bring to life these goals; conduct the lesson [tutorial] in a classroom, with a team member teaching [tutoring] and others gathering evidence on student learning and development; and discuss the evidence gathered during the lesson [tutorial], using it to improve the lesson [tutorial], the unit, and instruction more generally (p. 95)*

Within the context of this chapter, a lesson study framework as a form of TPD for tutors is a tutor-enquiry based CPD whose specific emphasis is to reflect on tutoring classroom practices and students' cognition, thus developing the tutor's expertise and learning within a higher education context [49, 51]. Tutor-enquiry based training using a lesson study, and more specifically a research tutorial, is a possible solution for the TPD of tutors in higher education. A research tutorial is a tutorial that is jointly planned (prepared), implemented, and evaluated through reflections by both tutors and researchers within a discipline and/or degree programme. This chapter uses the term 'researchers' to refer to: academics, such as lecturers and convenors of higher education courses, as well as other higher education stakeholders in higher education, whose interests lie in tutor development. As such, the research tutorial is examined through three lenses [52]: The first is *the researcher lens,* which encourages tutors to act as researchers in identifying problems of practice (such as students' productive struggles), designing appropriate strategies to solve them, and using the findings to inform and improve the success of their tutoring interventions. While the role of the tutor is to help students to learn, there is general acceptance that undergraduate students, through no fault of their own, find it difficult to assess their own knowledge deficits [1]. It is one of the tutor's roles to design and provide interventions to ameliorate such knowledge deficit challenges among students [53], ideally, by gathering information about the level of understanding among the students in the group [54, 55]. The second, *the curriculum development lens,* looks at how tutors sequence learning tutorial activities and align them to the students' learning and cognition during tutorials. In addition, the act of tutoring involves further challenging the students' cognition, particularly with respect to simplification, clarification, and exemplification of learning tasks [39]. Lastly, *the student lens*, is about how tutors predict possible solutions and challenges to students' learning tasks, and how they use these predictions to inform further student engagement. In addition, this lens refers to how tutors use their knowledge about students, and their knowledge of their peers as resources for planning, facilitating and evaluating students' interactions during tutorials. It is relevant to mention that the tutor's main role is to create an environment that supports student learning; often, however, tutors find themselves dealing with students' other distressing and intensely personal issues, which are not part of their discipline context [44, 56].

Considering what has been said earlier, this chapter discusses tutoring in an undergraduate course—viz. the QL course, so the context presented is very specific to this course. While tutors have many different roles, the focus in this chapter is on classroom practice and discourse, in other words, on facilitating the discipline content. Only postgraduate students from quantitative disciplines are interviewed and, if selected, are eligible to be tutors for this course. Successful candidates are required to attend a compulsory orientation seminar before assuming their tutoring duties, and before being subjected to further training, as defined by the research

tutorial framework. It is during the orientation seminar that tutors, and researchers discuss the learning needs of the students in the course, as well as the curricular goals of the course. In addition, the orientation seminar is used to assess the developmental needs of tutors before they engage in tutoring.

The research tutorial framework that the chapter is proposing consists of four phases. The characteristics of this framework make it an effective tool for TPD, because 'it is site-based, practice-oriented, focussed on student learning, collaboration-based, and research-oriented' ([57], p. 2). In other words, the framework can be adapted to address the needs of the tutors and student learning in a variety of contexts. **Figure 1** shows the four phases of the research tutorial framework, viz. *setting goals, planning, implementing, and debriefing*, and how these are related to each other [58].

Firstly, in the *setting goals phase*, tutors and researchers meet formally to discuss the specific students' needs, and the curriculum goal for the undergraduate QL

Phases of a research tutorial	Tutors' and researchers' co-learning activities from the research tutorial	Outcomes
1. Setting goals	Tutors and researchers discuss the objectives of the research tutorial within the contexts of the students' academic needs, and curricular goals.	**TPD leads to improvements in:** tutor classroom practices; classroom discourses; student-tutor interactions; deeper understanding of the subject content; student learning; tutor critical inquiry and reflection on tutorials; knowledge of a variety of instructional methods; and flexibility to change instructional strategies during tutoring **For students, quality tutoring leads to improvements in:** success rates; retentions of at-risk students; and undergraduates' sense of social and academic integration
	Between Phases 1 & 2: Tutors and researchers brainstorm and research the mathematics concepts and think about concepts that are likely to present conceptual challenges to students.	
2. Planning	Developing a plan for the research tutorial; deciding on the approach to facilitate the research tutorial and its justification; deciding on data collection strategies; anticipating responding students' conceptual challenges using case students; thinking of ways to identify and respond to students' productive struggles; seeking ways of promoting dialogic talk between tutors and students.	
	Between Phases 2 & 3: Carefully considering the illustrational strategy to be used; performing trial runs of the data collection methods – as evidence of students' engagements and interactions; acclimatising students to the various data collection methods, for example, video-recording.	
3. Implementing	One tutor facilitates the research tutorial; one or two members observe and collect data on student learning using a pre-determined research instrument, for example, an observation guide; data is also collected through video-recordings and students' written samples, among others.	
	Between Phases 3 & 4: Researchers and tutors individually reflect on the activities accomplished by the research tutorial – by developing comments from notes made in the previous three phases of the research tutorial.	
4. Debriefing	Data collected by the tutors and researchers is analysed; discussions pertinent to student and tutor learning, in addition to pedagogical content learning, take place.	
	Between Phases 4 & 1: Evidence collected is used to inform decisions on: whether certain concepts in the research tutorial need to be re-taught; whether changes to the tutorial are required to make it more accessible to students.	

Feedback on future research tutorial development, and TPD and student learning

Figure 1.
Phases of a research tutorial.

course. Between Phases 1 and 2, tutors and researchers engage in brainstorming activities, where pertinent mathematical concepts and potential students' conceptual learning challenges are discussed.

Secondly, in the *planning phase*, the tutors and the researchers develop a plan for the research tutorial and why it should take a specific format, which is usually informed by the students' needs. Since research tutorials are evidence driven, tutors and researchers decide on the nature of the data collection strategies to be used. Part of the discussions look at how to anticipate and respond to the students' conceptual challenges using so-called 'case students'.

As defined in this chapter, case students are, for example, three students known to the tutors and the researchers, around whom the tutorial is planned. In other words, the planning phase looks at specific named students in a tutorial in each of the three categories: low, average, and high performers, and designs the tutorial around their needs. So, each of the tutorial planning activities is focused at addressing the needs of these case students, and by extension the rest of the students in the group [48, 59].

Part of the emphasis of the planning stage is on creating a learning environment that promotes the construct of dialogic talk, which requires tutors to use high order questioning that promotes critical thinking [60]—for example, Socratic questioning [61], and feedback that promotes alternative discourses [62, 63]. Pertinent characteristics of dialogic talk are: *collective*—an all-inclusive interaction between students and tutors; *reciprocal*—tutors and students listening to each other; *supportive*—tutors create an environment where individuals' views are valued and respected; *cumulative*—tutors and students create new and coherent lines of cognition by using each other's ideas as learning resources; and *purposeful*—tutors' and students' and/or group interactions are guided by students' educational needs and curriculum goals [2, 64]. This is contrary to studies on tutor-student interactions, which have found that classroom discourses are predominantly tutor-centred, in that tutors ask the questions and students respond, using short answers in the form of 'yes' or 'no' [65, 66], as in the case of classroom discourses observed in schools [67]. Between Phases 2 and 3, tutors and researchers finalise their data collection strategies, by doing trial runs and preparing students for the implementation of the planned activities from Phase 2.

Thirdly, in the *implementation phase*, one of the tutors facilitates the tutorials, using the guidelines established in Phase 2; the tutorial activities are both video- and audio-recorded. The other tutors and the researchers act as observers, using a pre-determined observation guide to monitor student-tutor and student-student interactions. Samples of the students' work are also collected as evidence for the students' ways of working. The facilitator and the observers keep a keen interest on the three case students' interactions, and predictions are made on how they are likely to perform during the research tutorial. Between Phases 3 and 4, tutors and researchers reflect on the accomplishments of the research tutor during the implementation phase and on the research tutorial in general—this is done informally, and by developing and sharing notes made during the previous three phases.

Fourthly, during the *debriefing phase*, tutors and researchers hold a post-research tutorial meeting, where data collected, and notes made during the previous three phases—setting goals, planning and implementation—are analysed. In addition, it includes discussions pertinent to the research tutorial itself, such as: classroom discourses, student and tutor learning moments and/or strategies, accomplishment of learning, and meeting of curriculum goals. Discussions around the three case students take place, looking specifically at whether the predictions about their interactions were correct. Between research tutorial Phases 4 and 1, evidence collected in the previous four phases is used by tutors and researchers to inform decisions on:

whether selected concepts in the research tutorial need to be re-taught; whether changes to the tutorial are required to make it more accessible to students; whether new strategies to improve deep learning should be pursued; and how interactions and engagement by students and tutors in research tutorial classroom practices can be enhanced.

5. The operationalisation of a research tutorial

Having presented the research tutorial framework in the previous section, in this section the discussion centres on how the framework can be operationalised in a Humanities first year undergraduate QL course with a specific research tutorial on the *percentage change* concept—see appendix. According to the research tutorial framework, the participants in the operationalisation of the tutor training are: three researchers, five tutors—all postgraduate students, and a research assistant. All participants take part in all the research tutorial activities. While the research tutorial posed two questions, the focus of the discussion in this chapter is on question 1 only, as shown in the appendix.

Students enrolled in this QL course mainly do Psychology as a major; however, students from other social sciences disciplines, such as social work, are also admitted to the course. Readers need to note that the majority of the students who enrolled in the QL course obtained low grades in their final year of high school and are characterised by their low interest in mathematics or learning activities that require an understanding of numbers and their applications. The construct of QL embodies 'the ability to understand, interpret, evaluate, and apply numerical [mathematical and statistical] data, as well as the ability to communicate mathematical ideas in various formats' [68]. On a practical level, QL promotes quantitative reasoning and logical thinking that assist students when dealing with quantitative issues, both in their discipline and in the real world, as informed, literate, and democratic citizens. Using the research tutorial shown in the appendix as an example, the following section illustrates how the four research tutorial phases—setting goals, planning, implementation, and debriefing—can be used for tutor training or TPD.

Firstly, in the *setting goals phase*, the curriculum goals of the topic, viz. *percentage changes*, is partly introduced during the orientation and induction of the tutors. The specific curriculum goals of the research tutorial are discussed in detail for each tutorial. For instance, in this research tutorial, the objectives of the research tutorial are: *calculate a percentage change and use growth factors to find quantities before and after an increase; read percentage changes from charts, tables, and texts; interpret charts in terms of percentage changes; communicate information about percentage changes—by writing statements describing the percentage changes in context; and calculate the orders of magnitudes.* These research tutorial objectives were agreed upon with an inter-rater reliability of above 90%; in other words, a consensus was reached by tutors and researchers that these were indeed the key objective of the tutorial.

Secondly, in the *planning stage*, which is about planning for data collection, one of the tutors, for example, asked the question: 'How do I address the students' productive struggles within the context of the tutorial objectives?'. In this stage, the research tutorial is also observed from the students' perspective, i.e. 'now as the student you will be trying to grapple with percentage change concepts from the tutorial to make sense of certain issues being raised ... and [look at how] the tutors respond to the students' [researcher]. During the planning stage, tutors recorded that question 1 (c) read: 'What was the percentage change in murder figures from 2005/6 to

2006/7 for Mpumalanga and Northern Cape?' And that this should be scaffolded to its current form—see appendix. This scaffolding was intended to allow a better understanding of the question by the students. In addition, the observers also focused on the extent to which the tutor accomplishes the objectives and the nature of students-tutor interactions.

Thirdly, in the *implementation phase,* in this research tutorial one tutor facilitates, another tutor acts as an observer, and a research assistant acts as a second observer; all tutor-student interactions are recorded. By 'attending'—recognising and/or noticing, identifying, and responding to the students' productive struggles on the concept of percentage changes—tutors sought to address the tutorial objectives [69–71]. In other words, the construct of the mathematical noticing framework includes: attending to, interpreting, and deciding how the tutor's responses to the students' productive struggles plays a critical role during the facilitation of the research tutorial [72]. The research assistant posits that, 'Students seem confused on all the information necessary to include in a definition as in question 1 (a)'. In response, the tutor tells students to 'look at the title of the chart and try to answer the questions: who? what? where?—and when?' [tutor] [73]. Part of the students' productive struggles can be attributed to a 'sense or meaning making', i.e. uncertainty in explaining, and expressing misconceptions and errors [74–76]. For instance, a student displays a misconception in question 1 (c) (ii): 'students think that using the percentage change, she/he can conclude that there were more murders in the Northern Cape than Mpumalanga' [observer]. When asked by the tutor to explain his/her answer, the student responded that, 'Mpumalanga had a decrease while the Northern Cape has had an increase in the amount of murders'. The tutor used directed guidance, by asking leading questions to get students to explain their reasoning; for example, in question 1 (c) (ii), the tutor asked the student why she/he chose yes, even though that was the incorrect answer [73]. These are just a few examples of the student-tutor interactions that took place during the implementation of the research tutorial. The three case students were monitored; one tutor posited that 'the predictions of the three case students were correct, since all of them performed as anticipated' [tutor]. Studies have shown that the tutors' [teachers'] predictions about case students are usually incorrect, probably because the tutors poorly assessed the case students [48].

Lastly, the *debriefing phase* constitutes the reflections on the research tutorial by both the tutors and the researchers, looking at how the data collected can inform and improve both student learning and tutoring on the concept of percentage. Students' productive struggles were specifically experienced in respect of question 1 (h). Tutors' reflections acknowledge that 'Question 1 (h) presented the most uncertainty for students. All of them struggled with the mathematical conceptual understanding of the question' [tutor]. Students appeared to have a misconception that they could just find an average of the nine provinces' percentages given to find the overall murder percentage of South Africa—this was a misconception because students were failing to understand that the provincial percentages and the national percentage (3.6%) were calculated using different absolute totals. Evidence collected during the implementation phase of the research tutorial showed that, even where scaffolding was done, students still found it challenging to understand the application of growth factors—derived from percentage changes, and to use them to solve authentic real word problems. While none of the tutors suggested that the research tutorial should be re-taught, tutors were concerned about the misconceptions and errors students had shown during the tutorial. In the main, the tutors recommended that the students needed more practical exercises on solving problems relating to growth factors, particularly where real-world contexts are concerned.

From this illustrative example of a specific QL-based research tutorial on percentage changes, the cyclical characteristic of the research tutorial can be observed. While this example is based on a research tutorial, the framework can also be applied to subsequent tutorials, thus adding to continuity within the TPD. The author is not claiming that the research tutorial framework proposed in this chapter addresses all the challenges associated with students' lack of engagement during tutorials but does posit that it provides an alternative approach to tutor training, an area that is under-researched in higher education disciplines.

6. Conclusion

Tutoring and tutor training by using a research tutorial framework, as proposed in this chapter, are critical components of higher education learning and teaching that are intrinsically linked to the students' deep learning strategies, in other words, meaning-making and development of complex conceptualisation of discipline content, which lead to enhanced student engagements and interactions during learning, improved throughputs, and greater access [77, 78]. The tutor training discussed in this study, through the use of a research tutorial, seeks to address discipline-specific skills development of tutors in an undergraduate QL course, and does not address 'generic tutoring skills such as presentation skills, taking control of a tutorial session and responding in an emotionally responsible and mature manner to students' requests and actions' ([79], p. 29). Discipline-specific skills development includes but is not limited to: mastery of disciplinary content knowledge—QL content; supporting students' productive struggles within the discipline content; designing and implementing new instructional strategies during tutorials; and promoting mathematical and statistical classroom discourses during tutorials. As demonstrated in this chapter, TPD by means of an evidence-driven research tutorial can have huge implications for promoting students' active engagements and supporting their productive struggles during learning. The author argues that the role of tutors has become more complex, given the diversity and unpreparedness of the students enrolled in higher education institutions. Given also that there is an expectation for tutors to use student-centred alternative approaches, and that most of the tutors are postgraduate students without formal tutor training, there is a strong need for university departments to develop TPD, like the one described in this chapter. In conclusion, there is a need to research the effectiveness of the research tutorial as an alternative TPD method, with a focus on disciplinary content and classroom discourses. In addition, future research should include focussing on how tutors notice, and attend to the students' productive struggles during an undergraduate QL tutorial through deep questioning.

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Conflict of interest

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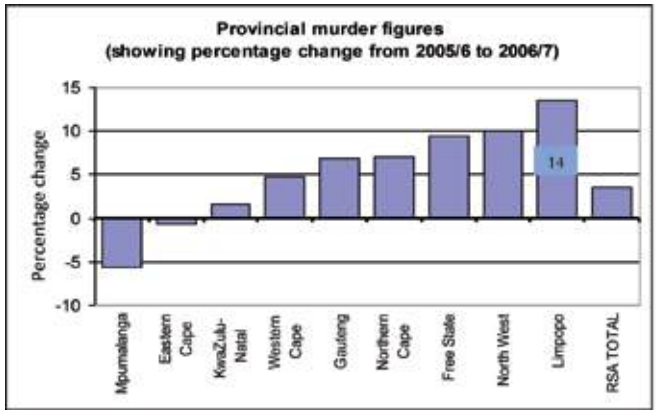
Appendix: Research tutorial—percentage change

The chart below has been adapted from data in *The Annual Report of the South African Police Service for 2006/2007*. The questions relate to the chart and to the table alongside.



Provincial murder figures	
PROVINCE	**2006/7**
Mpumalanga	
Eastern Cape	3 705
Western	2 881
Gauteng	3 666
Northern	400
Free State	
RSA TOTAL	**19 202**

a. Describe in full the meaning of the number 14 in the bar on the chart.

b. Consider the following statements based on the chart and select the one that best describes the value for the Western Cape:

   i. The percentage change in murder figures in the Western Cape from 2005/6 to 2006/7 was more than 4%.

   ii. The percentage change in murder figures in the Western Cape from 2005/6 to 2006/7 was almost 5%.

c. What was the percentage change in murder figures from 2005/6 to 2006/7 for Mpumalanga and Northern Cape?

   i. In each case say what this means about how the number of murders has changed in the province.

   ii. Can you use the answer in (i) to conclude that there were more murders in the Northern Cape than in Mpumalanga?

d. Which province had the smallest percentage change (irrespective of the sign) in murders? What is the percentage change for this province?

e. It is known that the number of murders in the Free State in 2005/6 was 876. How many murders were there in 2006/7?

f. It is known that the number of murders in Mpumalanga in 2005/6 was 874. How many murders were there in 2006/7?

g. How many murders were there in Gauteng in 2005/6?

h. The percentage change for RSA is given as 3.6%. Is this value the average for the percentage change values for the nine provinces?

If yes, confirm the calculation of the value. If no, say how the figure of 3.6% would have been calculated.

i. What proportion of all murders in 2006/7 was committed in the Western Cape? Express the answer as a percentage.

j. In 2006/7 how many times as big was the number of murders in South Africa as the number of murders in the Northern Cape? Write your answer as a whole number.

i. Complete the proportion in the following sentence:

ii. The Northern Cape had only ⋯ of all murders in South Africa in 2006/7.

c. By how many orders of magnitude was the Eastern Cape's number of murders in 2006/7 bigger than that of the Northern Cape?

Author details

Duncan Mhakure
Department of Academic Development Programme, Centre for Higher Education Development, University of Cape Town, South Africa

*Address all correspondence to: duncan.mhakure@uct.ac.za

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Section 3

Students in Basic and Higher Education

Chapter 6

The Power of Appearance: Students' Impression Management within Class

Sarah Forster-Heinzer, Arvid Nagel and Horst Biedermann

Abstract

Although educational research acknowledges that social perception processes are relevant for understanding but also evaluating situations, the topic of impression management (IM) has achieved only little attention so far. Individuals have discussed rather as passively exposed to the mechanism of social interaction and perception processes. This contribution changes perspectives and addresses the question of conscious impression management within classes. The chapter asks whether students use self-presentation tactics in order to deliberately navigate the impression their teachers should have of them. By means of an empirical study, country- and gender-specific differences with regard to impression management were found. Likewise, students with a high educational aspiration and good school grades scored higher or at least differently on impression management than students with a low educational aspiration level and low school grades. And students with a high educational aspiration but low grades try to overcome this discrepancy by means of personally adapting to the teachers' expectations. Even though the influence mechanism of impression management on school success cannot conclusively be answered, this paper opens new perspectives on the scientific discourse of social inequality as well as teaching quality and discusses implications for teacher education.

Keywords: impression management, self-presentation tactics, social interaction processes, teacher-student relationship, student engagement

1. Introduction

Teaching can be understood as a form of pedagogical action and communication (cf. [1]). Teachers meet a group of students, and only through the effort of all involved, successful teaching and learning is possible (cf. [1–3]). Social interaction between teacher and students but also between students themselves is a necessary but also momentous fact. In contrast to fleeting everyday encounters, students and teachers work together over a longer period of time. Within the framework of teaching and class organisation, they (compulsorily) enter into a long-term relationship (cf. [1]). As numerous social-psychological studies have shown (cf. [4, 5]), mutual perception is (socially) constructed and dependent on attitudes, expectations and experiences. Such expectations, norms and rules also exist at school, as the following quote illustrates: "At school, teachers and students interact.

Their actions are linked to social expectations and roles. [...] If expectations are met, recognition and reward follow, if they are not met, rejection, punishment or even sanction follow. [...] The better students adapt to teachers' expectations and ideas and the better they succeed in camouflaging themselves by integrating both curricula [official and secret curriculum, authors' note], the greater the chance for a successful school career" ([6], pp. 101 and 109, translated from German by the authors). Empirical studies confirmed that on the one hand, students are able to influence teachers' perception and assessment (cf. [7, 8]) and on the other hand that the teachers' perception has consequences for students. Thus, as, for instance, the following references [9, 10] emphasised, students, who are perceived as more committed by their teacher often have better grades than those who are perceived as less committed, with the same school performance. In this context, Reichenbach [11] speaks of privileged students and means that those students who know and understand how to present themselves according to expectations and norms have a higher chance of success at school. Impression management (IM) therefore plays an important role not only in everyday life (cf. [12, 13]) but also in school careers (cf. [11, 14–16]). The aim of this contribution is to elaborate conceptually as well as empirically students' IM within class. Thus, despite its obvious significance, IM of students has received little interest from educational research so far.

2. Impression management

2.1 The presentation of the self

The topic of IM has gained some attention within sociology (cf. [13]) as well as social psychology (cf. [17]). Commonly, impression management is defined as an individual's active efforts to cast himself/herself in a certain light, to present, create and maintain a specific image in public (social situation) with a particular purpose (cf. [9, 13, 18]). Since IM is concerned with the image a person tries to convey to another person, on the one hand, IM expresses itself in self-presentation. On the other hand, self-presentation tactics serve the purpose of IM. Self-presentation therefore is a process "by which people [try to] convey to others that they are a certain kind of person or possess certain characteristics" ([17], p. 3). Consequently, the self has an inherent role in IM and can be defined as a cognitive structure that allows a person to think consciously about himself/herself and allows interpretation which are directed towards understanding one's own inner world (cf. [17, 19]). Although one could argue that self-presentation is involved in every social encounter whether conscious or not, in literature, it is often used as synonym to impression management, which describes a conscious process of managing the self-presentation. With regard to the school context, a student might be more or less concerned about the image the teacher has of him/her and therefore invests more or less in IM. If the student is more concerned and provided, he/she understands the expectations and norms of the teacher; he/she will probably invest more in presenting the self as being committed, motivated and interested within class. In other words, to care about the impression one leaves in a situation requires that students are aware of social perceptual processes and the fact that one always leaves an impression, whether intentional or not. Leary [17] distinguished between four levels of impression monitoring. On the level of *impression oblivion*, a person is unaware "even of the possibility that others are forming impressions of him or her" ([17], p. 49). This level is, however, relatively rare [17]. Nevertheless, students who are at this level of oblivion may be at a disadvantage because, as mentioned earlier, grades are also influenced by how teachers perceive their students' commitment.

On the second level, the *pre-attentive impression scanning*, a person manages the impression at a rather unconscious or pre-attentive level while focussing on other things. If a person is "consciously aware that others may be forming impressions of him or he" ([17], p. 49), he/she is at the level of *impression awareness*. On the level of *impression focus*, a person is consciously aware of the impression he/she makes, and all the person's thoughts are concentrated on this impression and the consequences. This level might be very stressful, as a person has no room for other things or foci. Leary [17] highlighted: "ironically, then people may be so consumed by thoughts of the impressions they are making that they end up making undesired impressions." In the context of school, a student might be so focused on how he/she appears during an oral speech that he/she will not be able to focus on the speech's content. Most of the time, students probably move between levels 2 and 3 as the line between consciousness and unconsciousness is often very blurred. When managing the impression one wants to leave in a situation, however, impression awareness is required. Nevertheless, not everyone seems to be equally successful in self-presentation. Goffman [13] stressed that for successful self-presentation, the public (i.e., the teacher) must be convinced of the sincerity of the presentation. For this to succeed, even the impressionist must have a clear idea of what his audience expects; he must know how judgements come about and possess sensitivity for what the respective social situation demands (cf. [20]). Meaning, the successful handling of school demands and expectations requires that newly entering children quickly understand the role they have to play, the position they have to fill and the rules they have to follow. They need to recognise how an institution works, and they need to acquire the necessary organisational knowledge (cf. [16]). Some students might intuitively know how to make a good impression. From a sociological perspective, knowing how to behave appropriately can be explained with the concept of frame (cf. [21]). Frames are cultural specifications providing guidelines as to how to engage in situations (cf. [22]). It is to assume that students, familiar with a cultural context, usually know that it is beneficial to *show* interest in the learning subject during class (and not only to *be* interested) and to demonstratively *show* their own motivation (and not only to *be* motivated). Moreover, it is beneficial if motivation and interest is missing in a situation, to present the self at least as if interested and motivated (cf. [13]). Even though IM can be related to pretending and deceiving, it does not necessarily have to be false and untrue. A positive IM is likewise important independently of the presence or absence of motivation and interest in the given situation. Motivation, however, to present the self in correspondence with the teacher's expectations is needed.

2.2 Motivation and function of impression management

Presenting the self is an inherent part of every social situation regardless of whether the individual is aware of it. Thus, individuals involved in social encounters constantly seek information from each other in order to define the situation, formulate expectations and align their own behaviour accordingly (cf. [13, 17, 22]). Motivation to regulate how they are perceived by others might result from the belief that the impressions others form of them are relevant to achieve a certain goal which is valuable or important to them or to overcome a discrepancy between the impressions they desire others to have of them (presented self [19]) and the image they think others actually hold of them (appearing self [19]; see also [1, 17]). In the context of school, a student might wish to enter university and therefore is interested in good grades. If this student understands that grades are influenced not only by performance but also by the impression he/she makes in terms of commitment, interest and motivation, he/she is likely to invest more in IM. Likewise if a student

experiences a discrepancy between actual school grades and educational aspiration, he/she might invest more in IM (cf. [1]) or if the student wants his/her teacher to have a certain (good) impression of him/her, but does not yet think to appear as such (cf. [19]). IM and self-presentation tactics are, however, not only influenced by the person's goals and attributed value but also by norms and roles. Norms specify how people should act and what images they should or should not convey in particular situations and are gender-, context- and culture-specific (cf. [17]). For instance, boys are encouraged to act independent, powerful and competent, whereas girls are encouraged to be expressive, interpersonal and nurturant [17]. These different expectations result consequently in different self-presentation tactics. Beside influencing other people's behaviour and attitudes, IM serves the individual for constructing and maintaining the self-esteem as well as emotional regulation. But it has also an interpersonal function as a certain degree of concern of one's public impression is considered essential for smooth and successful social interaction (cf. [13, 17]). With regard to school, students' are being concerned about a good impression contribute to a more smoothly running teaching with less disturbances (cf. [1, 16]). Managing a good impression in social situations (i.e., during teaching) is therefore also linked to courtesy and respect for the other(s) (cf. [1, 11, 13]). To teachers this means that it should be important to them that all students understand the expectations, norms and cultural frames of schools and classrooms. Teachers can thus support their students in presenting themselves in a good light by discussing such norms and expectations as well as successful impression management.

2.3 Students' impression management within class

Empirical studies such as the self-fulfilling prophecy [23], the halo effect [4, 5] as well as the Matthew effect [24] confirmed the significance of a positive perception of the student for school success. These studies, however, took a rather unidirectional perspective on the teacher-student relationship and the social interaction process, picturing the students as rather passively exposed to the teachers' expectations. Attributing the students as an active part in the social interaction process and attesting them the power to be able to influence the teachers' perception has not been the focus of research so far. Nevertheless, there are a few studies reporting that students are actually able to self-verify and to influence the teachers' perception (cf. [7, 8]). In the 1980s, some researchers asked students for advice they would give their younger siblings to succeed at school, implicitly addressing students' self-presentation tactics (cf. [14, 25, 26]). Eder [14] identified nine different categories of advices, recommended to younger siblings: (1) cooperation and learning, (2) demonstrative engagement, (3) identification, (4) integration, (5) situational adaptation, (6) personal adaptation, (7) ingratiation, (8) resistance and (9) distance and withdrawal. An analysis of the nine categories showed that four categories (2, 5, 6 and 7) represent self-presentation tactics which consciously aim at conveying to the teacher the image of a motivated, interested and competent student [27]. Maschke and Stecher [16] operationalised these nine categories of students' advices and assigned them to three dimensions: (1) learning work, (2) relationship cultivation and (3) self-assertion. The dimensions learning work and relationship cultivation were also related to IM. The amount of quantitative studies on students' impression strategies is very small. By means of qualitative studies, however, the students' awareness of IM's importance as well as their conscious employment of IM strategies was confirmed (cf. [1, 28]). Woods [28] found that students use different strategies and tactics in order to meet the teachers' expectation and to attract positive attention—for example, through a positive

positioning within question-answer teaching. In our own study [15, 27], student's IM within German teaching was studied. The study's focus was on the students' self-presentation tactics that deliberately try to convey a positive image of the self as being interested, motivated and competent. Based on the self-presentation tactics of Eder [14], five different dimensions of IM could be extracted: demonstrative engagement, self-promotion, situational adaptation, personal adaptation and ingratiation (see Section 4.2). While demonstrative engagement describes the active effort to appear as interested and committed through participation, situational adaption tactics are used not to let demotivation or disinterest show. Personal adaptation and ingratiation describe tactics that rather invest in relationship work with the teacher. Self-promotion takes somehow a special position as it refers to showing one's own competence in situation in which one does not entirely understand what the teacher tries to explain. It was found that those students who experience a discrepancy in the sense that they perceive themselves more positively (real self)[1] than they think they are perceived (appearing self) or that they want to be perceived more positively (presented self) than they think they are perceived seem to invest more in their relationship work with their German class teacher through conscious impression management [15]. These results confirm the hypothesis that experienced discrepancy is a motivator for IM [17].

3. Research questions

With regard to the empirical part of this contribution, the aim was to deepen the understanding of students' IM within class and to analyse motivational aspects but also context-related differences resulting from the cultural context as well as from gender norms. Therefore, the first question addresses country-specific differences in terms of IM. The second question asks whether female students differ in their IM from male students. Question three, finally, studies the relationship between school grades, aspiration level and IM and asks for interactional effects on IM (discrepancy hypothesis).

1. Are there any country-specific differences with regard to IM in math teaching?

2. Are there any gender-specific differences with regard to IM in math teaching?

3. Is there a correlation and interactional effect of aspiration and school grades with IM?

4. Method

In order to answer the research questions (see Section 3) a paper-pencil questionnaire study with foremost closed items on IM was conducted. Data collection took place during a school lesson (class wise), and it took the students about 30 minutes to complete the questionnaire. Trained test administrators ensured a standardised survey process. The survey was conducted by class. All items were

[1] The distinction between real, ideal, appearing and presented self was made by Fend [19]. The real self describes the way I see myself; the ideal self is the self I would like to be/become. The self I think others attribute to me is the appearing self (as I think to appear/be perceived by others), and the self I wish others would attribute to me is called presented self.

related to math teaching and its belonging teacher.[2] The sample is an occasional sample, not randomly drawn.

4.1 Participants

A total of 293 students at the secondary II level (seventh-tenth grade) responded to the questionnaire. In order to test for country-specific differences, 202 students were at Austrian grammar schools (69%) and 91 at Swiss grammar schools. About 46% were female (135) and 154 students were male (4 missing answers). The average age was about 14.5 years (SD = 1.6 years). Since all students questioned were at a grammar school which prepares them for university entrance, it is not surprising that 65% of the respondents are aiming for an education at university. However, 35% of the students did not mention at the time of survey that they aspire to enter university but had other perspectives or more immediate goals such as obtaining the graduation certificate of grammar school. About 5% of the students reported to have insufficient math grades, about 38% of the students had sufficient math grades, and about 32% had good and another 24% very good math grades. **Table 1** gives an overview of the sample characteristics.

4.2 Scales and measures

Besides some socio-demographic variables such as gender, country and age, the newly developed questionnaire included questions on educational aspiration and school grades in math as well as items on IM (adapted for math teaching). The scales, dimensions and items as well as some scale characteristics will be described in more detail.

4.2.1 Scale: impression management

As mentioned (see Section 2.3) in a previous study [15, 27], students' IM was operationalized and validated with regard to teaching of German and its belonging teacher.[3] Based on school-specific coping strategies identified by Eder [14], this instrument was supposed to capture the student perspective on self-presentation tactics. By means of a CFA with latent constructs [27], a five-dimensional correlative factor structure was confirmed. For this current study, the correlative five-dimensional IM scale for German teaching was adapted to math teaching. All items could be answered on a four-point Likert-scale ranging from *does not apply* to *applies*. An even number of response categories was chosen to avoid a neutral response opportunity.[4]

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[2] It is to assume that students adapt their IM depending on the school subject but especially its belonging teacher. Therefore, the items of IM were formulated with reference to math teaching.

[3] The sample of validation consisted of 201 students at Austrian grammar schools [27].

[4] There has been some methodological discussion about whether an even or odd number of response categories should be used when constructing a questionnaire with closed answer format [29]. The central argument for collecting and measuring a construct with a straight response category (with four or six levels) is that the participants questioned are deprived of the opportunity to position themselves indifferently or (only) in the middle of the item [29]. From a conceptual point of view, it would not make sense to have a neutral answer response when asking students about their deliberative effort for IM. Therefore, an even number of four-answer categories was chosen as it is also often applied in the PISA study when questioning attitudes or behaviour.

	Math teaching[a]
Total N	293
Austrian	202 (69%)
Swiss	91 (31%)
Female	135 (46%)
Male	154 (53%)[b]
Average age (SD)	14.5 (1.6 years)

[a]*The items on impression management were directed to the math teaching and its teacher.*
[b]*4 cases missing.*

Table 1.
Sample characteristics.

- *Demonstrative engagement* describes a conscious tactic of students to present themselves as motivated, interested and committed through active cooperation: *During math lessons I often get in touch with my teacher so that he/she thinks I am motivated*. (Three items)

- *Self-promotion* describes a students' tactic to present themselves as competent (knowing and understanding) even if one does not fully understand the subject of teaching: *In math lessons, even if I do not know the right solution, I try to behave as if I knew it*. (Three items)

- *Situational adaptation* is a rather adaptive tactic with the aim of not letting one's own noncommitment be noticed: *I will not let you tell me if I'm not interested in math lessons*. (Five items)

- *Personal adaptation* describes students adapting to the teacher's expectation of showing interest and motivation (relationship management): *In math lessons I sometimes fake motivation in order to leave a positive impression*. (Four items)

- *Ingratiation* is an active relationship management, with the aim of signalising recognition, respect and obedience to the teacher: *I pretend to meet the math teacher's expectations*. (Three items)

In order to analyse the reliability of IM dimensions, the extracted factor solutions were compared to the one of the German teaching sample (reference sample), and Cronbach's alphas were calculated. **Table 2** presents the scale characteristics for the math teaching sample. It shows that Cronbach's alphas of the different IM dimensions were ranging between 0.63 and 0.87,[5] which can be considered satisfactory for social science studies [30]. Furthermore, **Table 2** shows that the average scores of the five dimensions of IM were semantically between *somewhat does not apply* and *somewhat applies*.

4.3 Hypotheses

Since there are culture-specific norms which influences IM and self-presentation (cf. [13, 17]) and since school culture of countries probably differ in certain norms

[5] The Cronbach's alphas are comparable to the German teaching sample in which they varied between 0.66 and 0.86. Furthermore it showed that students answering the items with reference to math teaching and its belonging teacher did not differ in their mean score on IM dimensions compared to the students who answered the questions with reference to German teaching (reference sample).

	Sample size (n = 293)	
Dimensions of IM	**Mean (SD)**	**Cronbach's alpha**
Demonstrative engagement	2.63 (0.87)	0.87
Self-promotion	2.13 (0.82)	0.74
Situational adaptation	2.85 (0.68)	0.81
Personal adaptation	2.57 (0.69)	0.70
Ingratiation	2.62 (0.70)	0.63

Table 2.
Scale characteristics on IM for math teaching sample.

and expectations, it was assumed that students from Austrian grammar schools differ on average in their scores on IM from students from Swiss grammar schools. Differential learning environments have an individual influence on the description and development of cognitive and noncognitive outcomes of students. Such contextual factors can also be identified at the institutional or organisational level within the framework of educational spaces. Based on differences in the school structure between the Swiss and Austrian school education systems, but given the fact that studies comparing IM between students of Austrian and Swiss schools are missing, an undirected hypothesis was formulated (Hypothesis 1), which should be understood as rather explorative in nature. Likewise it was argued that genders also are confronted with different expectations and norms [17]. Therefore, it was expected that male students score higher on self-promotion and female students score higher on IM concerning explicit relationship management (personal adaptation and ingratiation, Hypotheses 2). In general, students with a higher educational aspiration level are expected to be more interested in a positive IM and therefore score higher on the self-presentation tactics (Hypothesis 3). Likewise, students with good grades are expected to have higher scores on IM (Hypothesis 4). With regard to the motivation of IM [17], it is expected that students experiencing a discrepancy (high aspiration level but low school grades) are more interested in a good IM and therefore score higher on its dimensions (Hypothesis 5).

- **Hypothesis 1**: Students from Austrian grammar schools differ in their IM from students from Swiss grammar schools.

- **Hypothesis 2**: Due to gender-specific norms, it is expected that on the one hand, male students score higher on self-promotion (demonstrating competence, Hypothesis 2a) and on the other hand, that female students score higher on personal adaptation (Hypothesis 2b) and ingratiation (Hypothesis 2c), both aiming at conscious teacher-student relationship management.

- **Hypothesis 3**: Students who aim at entering university (high aspiration level) score higher in the IM dimensions than students with a lower aspiration level.

- **Hypothesis 4**: Students with good grades are expected to score higher on IM than students with lower grades.

- **Hypothesis 5**: Students with a high aspiration level but low school grades (discrepancy experience) score higher on IM than students with low grades and low educational aspiration level.

The methods used in order to test these hypotheses are discussed directly when presenting the corresponding results (see Section 5).

5. Results and discussion

5.1 Mean differences in impression management between countries

In order to test Hypothesis 1 that students from Austrian grammar schools differ in their average on IM in math teaching from students from Swiss grammar schools, t-tests for independent groups were calculated by means of the statistical program SPSS (Version 24). Significant country differences were found on four of the five dimensions on IM in math teaching. Only with regard to situational adaptation was no country-specific difference found. Generally, students from Austrian schools achieved higher mean scores on the dimensions of IM. Consequently, students from Austrian schools seem more involved in active impression management conveying the image of a competent, motivated and interested student that respects the teacher. The effect sizes[6] were, however, rather small between 0.36 and 0.40 (see **Table 3**). This study is not able to conclusively clarify these differences between countries, as there is a lack of information on different norms and expectations of students. Studies including school culture characteristics of different countries would be valuable for further understanding how context characteristics influence IM and self-presentation tactics.

5.2 Mean differences in impression management between genders

Hypothesis 2a–c assumed that male students score higher on self-promotion but less on personal adaptation and ingratiation than females do. Results showed, however, that—according to expectation—gender only differed significantly in the mean score of ingratiation and additionally on situational adaptation (method of analysis: independent sample t-test, SPSS; Version 24). Female students had higher average scores on both dimensions and seem to try more not to show disinterest or demotivation during class and try to ingratiate more than male students do. The effect sizes were, however, rather small with 0.26 and 0.40, respectively (see **Table 4**). The hypothesis that female students invest more into relationship management was therefore only partially confirmed. In order to analyse whether these

	Austria	Switzerland		
Scale	**Mean (SD)**	**Mean (SD)**	**t-value**	**Effect size d**
Demonstrative engagement	2.7 (0.86)	2.4 (0.88)	$t(285) = 2.72$; $p < 0.01$	0.36
Self-promotion	2.2 (0.83)	1.9 (0.74)	$t(290) = 3.22$; $p < 0.001$	0.39
Situational adaptation	2.9 (0.68)	2.8 (0.68)	$t(287) = 1.5$; ns	—
Personal adaptation	2.6 (0.68)	2.4 (0.68)	$t(284) = 3.06$; $p < 0.01$	0.40
Ingratiation	2.7 (0.66)	2.4 (0.75)	$t(285) = 3.03$; $p < 0.01$	0.38

Table 3.
Mean differences in impression management between students of Swiss and Austrian schools.

[6] Effect sizes were calculated using the formula *Hedges' g* in order to correct for unequal group sizes [31]. As Hedges' g is often used similar to Cohen's d, the abbreviation effect size d is used.

	Female students	Male students		
Scale	**Mean (SD)**	**Mean (SD)**	**t-value**	**Effect size d**
Demonstrative engagement	2.7 (0.89)	2.6 (0.86)	t(281) = 0.82; ns	—
Self-promotion	2.2 (0.83)	2.1(0.79)	t(286) = 1.15; ns	—
Situational adaptation	3.0 (0.63)	2.7 (0.70)	t(283) = 3.21; $p < 0.001$	0.40
Personal adaptation	2.6 (0.68)	2.5 (0.68)	t(280) = 1.49; ns	—
Ingratiation	2.7 (0.68)	2.5 (0.70)	t(281) = 2.14; $p < 0.05$	0.26

Table 4.
Mean differences in impression management between female and male students.

findings result from different gender-specific expectations that influence self-presentation tactics, it would be beneficial to include in a further study also information on such expectations.

5.3 Relationship between grades and educational aspiration with IM

In order to test Hypotheses 3 and 4, the educational aspiration as well as the math grades were dichotomised. Students who already knew they want to enter university were assigned to the group *aspiration high* which correspond to 65% of the participants. The others were allocated to the group *aspiration low*. Students (56%) reporting a math grade that means semantically "good" or "very good" were allocated to the group *high grades*, the others to the group *low grades*. By means of a 2×2 factorial ANOVA, it was tested for main and interaction effects of educational aspiration and math grades (independent variables). The dependent variables (DV) were the five dimensions of IM. For each DV a separate ANOVA was calculated. **Table 5** summarises the results of the ANOVA. With regard to Hypothesis 3, it was found that the educational aspiration level had an influence on self-promotion ($F(1, 277) = 4.482$; $p < 0.01$) as well as on ingratiation ($F(1, 273) = 4.61$; $p < 0.05$). In alignment with expectations, students in the group *high aspiration* scored on average higher on self-promotion (mean = 2.21, SD = 0.85), than the group *low aspiration* (mean = 2.02, SD = 0.73) as well as on ingratiation (mean = 2.70, SD = 0.66), than the group *low aspiration* (mean = 2.52, SD = 0.73). Effect sizes of these main effects were, however, rather low ranging between 0.265 and 0.271. With regard to Hypothesis 4, school grades were found to have an influence (main effect) on demonstrative engagement ($F(1, 272) = 7.661$ $p < 0.01$), self-promotion ($F(1, 277) = 6.523$; $p < 0.01$) as well as situational adaptation ($F(1, 274) = 4.526$; $p < 0.05$). The two dimensions of IM aiming more at relationship work seem not to be affected by student's school grades. Put differently, independent of the math grades, students tried more or less to ingratiate and personally adapt to the image of a good student. In accordance with Hypothesis 4, students in the group *high grades* scored on average higher on the IM dimension of demonstrative engagement (mean = 2.76, SD = 0.86) than the group *low grade* (mean = 2.49, SD = 0.85). Likewise, students with high grades scored on average higher on the dimension situational adaptation (mean = 2.92, SD = 0.66) than the group *low grade* (mean = 2.77, SD = 0.66). There are at least two possible explanations for these results: (1) investing more into demonstrative engagement of commitment and effort as well as investing more in not letting demotivation and disinterest show leads to better grades, and (2) understanding teaching as a trade, students with better grades trade for them with

	SS	df	MS	F[a]	Effect size d
Demonstrative engagement					
Aspiration level	0.759	1	0.759	1.037	ns
Math grade	5.607	1	5.607	7.661**	0.338
Aspiration*grade	0.707	1	0.707	0.966	ns
Error	199.078	272	0.732		
Self-promotion					
Aspiration level	2.826	1	2.826	4.482**	0.265
Grade	4.112	1	4.112	6.523*	0.309
Aspiration*math grade	1.657	1	1.657	2.628	ns
Error	174.628	277	0.630		
Situational adaptation					
Aspiration level	0.441	1	0.441	0.958	ns
Math grade	2.084	1	2.084	4.526*	0.259
Aspiration*math grade	0.582	1	0.582	1.265	ns
Error	126.161	274	0.460		
Personal adaptation					
Aspiration level	1.589	1	1.589	3.499	ns
Math grade	0.615	1	0.615	1.354	ns
Aspiration*math grade	2.498	1	2.498	5.501*	0.54
Error	123.524	272	0.454		
Ingratiation					
Aspiration level	2.173	1	2.173	4.610*	0.271
Math grade	0.541	1	0.541	1.148	ns
Aspiration*math grade	0.635	1	0.635	1.347	ns
Error	128.709	273	0.471		

[a]*$p < .05$, **$p < .01$, *ns = nonsignificant.*

Table 5.
Tests of 2 × 2 factorial ANOVA: Statistics for main effects and interactions between grades and aspiration on IM.

demonstrative engagement and situational adaptation. Contrary to expectation, students with high grades had lower mean score on self-promotion (mean = 2.01, SD = 0.79) than the group *low grade* (mean = 2.31, SD = 0.82). Again, there are at least two explanations possible: (1) there is no need for good students to show competence as their school performance already shows, and (2) good students are more aware of the "risks" of faking competence and understanding. Thus, if self-presentation is successful, the teacher is convinced that the students understood the content and proceeds to the next topic/step. Teachers may not recognise students' incomprehension and erroneous concepts. Due to the fact that there was only one measurement point (cross-sectional study), these various possible explanations cannot be conclusively clarified. Consequently, longitudinal studies are needed. Effect sizes of these main effects were, however, rather low ranging between 0.259 and 0.338.

Although Hypothesis 5 which states that students with a high aspiration level but low school grades (discrepancy experience) score higher on IM than students with

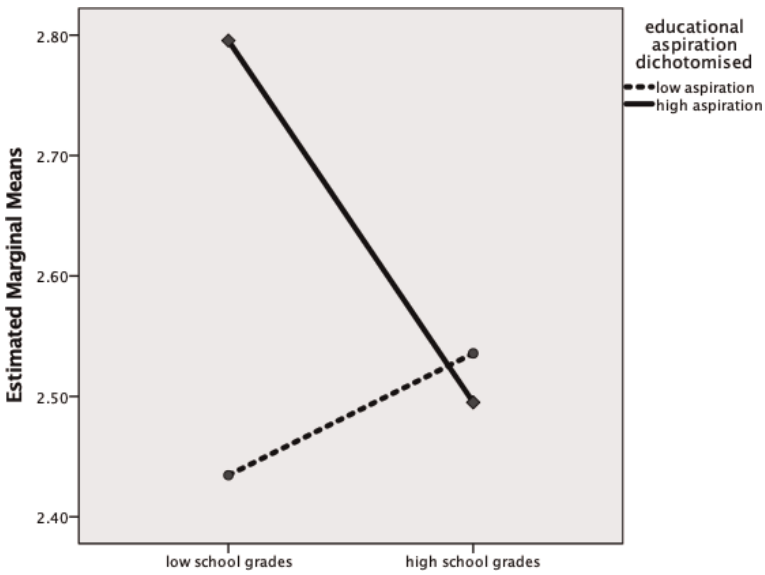

Figure 1.
Interaction effect of grade and aspiration regarding personal adaptation.

low grades and low aspiration level was apparently true comparing the mean scores of these two groups, only one significant interaction effect was found, namely, with regard to personal adaptation ($F(1, 272) = 5.501$; $p < 0.05$), with a medium effect size of 0.54. As **Figure 1** shows, students with a high educational aspiration but low math grades scored on average the highest on personal adaptation (mean = 2.80, SD = 0.64), students with low math grades and low aspiration the lowest (mean = 2.43, SD = 0.65). Students with a low educational aspiration but good math grades (mean = 2.54, SD = 0.67) scored similar like the students with a high aspiration level but low math grades (mean = 2.50, SD = 0.71). Students who want to start at university, but currently do not have good math grades, might hope to achieve better math grades when pretending and faking motivation and interest in order to leave a good impression. This would, however, require that students regard grades as influenceable by other factors than mere school performance (assessed through math exams).

6. Conclusion

Given the fact that compulsory schooling has not only expanded but has degraded to a preliminary state for attending higher educational institutions, the schools' function of selection in particular has become more important in recent years (cf. [1]). Consequently, school success students achieve during their school years is decisive for their future career. Not surprisingly, the quality of pedagogical diagnostics in the teaching profession has become a relevant topic of educational research (cf. [32]). But as discussed, student assessment (including summative and formative assessment) seems rarely to be based on purely objective measurement criteria but to open some scope for decision-making. Where there is scope for decision-making and consideration, there are consequently opportunities for social influence. The bigger this scope, the greater the significance of the many influences (or attempts to influence) on the impression made by the assessors (cf. [5, 20]).

Studies on teachers' judgement accuracy showed that on average the correlation between teacher's judgement and actual student's cognitive performance is only about 0.66. Depending on whether teachers judge cognitive performance or motivation, this coefficient is even lower (cf. [33, 34]). One discussed reason for this inaccuracy is that teachers can refer less to "hard facts" when they are assessing the student's self-concept than when they are assessing cognitive performance [33]. The question that could also be asked in this context is whether some students are more successful in conveying a positive self-image through successful impression management, which diminishes teacher's judgement accuracy regarding student's self-concept. There has been intensive research that teachers' perception on students' image has a profound influence on students learning (cf. [35]). Although IM and resulting social exchange processes are seen as important for school success, there are relatively few empirical studies that investigate the extent to which students as active agents have an influence on the teacher's student evaluation. On the contrary, the field of research seems to understand the student mainly as passively exposed to structural, contextual and teacher-based influences. The empirical results presented in this contribution confirmed, however, that students seem to be aware of their efforts in terms of (positive) impression management, not only in German but also in math teaching. They seem to know that they can avail themselves of specific tactics that can be applied for the purpose of self-presentation in different educational situations. It was found that students from Austrian grammar school scored on average higher on all five dimensions of IM than students from Swiss schools. The mean differences showed to be significant on four of the five dimensions. This indicates that different cultural norms might influence self-presentation tactics and corresponding behaviour. Whether these results have anything to do with different beliefs in authority or with the fact that in Switzerland, it is more frowned upon to present oneself as better (this can also be seen from the fact that acquired titles are rarely or only reluctantly listed by Swiss people), are theses to be examined. Likewise, gender-specific norms seem to influence IM within class. Although the effects were only significant with regard to ingratiation and situational adaptation, female students showed higher mean scores on all five dimensions of IM. This goes along with the argumentation that gender-specific norms expect females to be more expressive and interpersonal [17]. Thus the five dimensions of IM can be understood as a special kind of interpersonal expression, namely, to consciously present the self in a good way and connect with the teacher. Moreover, it was found that educational aspiration level had a significant effect on IM. Again, students with the already determined goal to enter university scored higher on all five dimensions of IM—even if the main effect was significant on only two dimensions (self-promotion and ingratiation). Furthermore, better school grades were linked to higher scores on demonstrative engagement and situational adaptation and to lower scores on self-promotion. Interestingly are the two significant main effects in terms of self-promotion. Whereas good students do less present themselves as being competent in situation in which they do not fully understand the school subject, students with high aspiration pretend more to being competent than student with lower educational aspiration do. This is important also for teachers to know. They should encourage their students to let them know if something was not understood fully instead of pretending to master subject matter. Because pretending to have mastered the subject matter of school may be detrimental to students' learning, especially if it leads to less effort on the part of the students. Finally, in alignment with the discrepancy hypothesis, it was found that students with a high educational aspiration (aiming for a university degree) but low grades (insufficient or barely sufficient) scored higher on all of the five dimensions than students with low

aspiration and low grades, with one significant interaction effect (personal adaptation). Against the background of these results, it seems to be reasonable and necessary to investigate more into what extent the use of self-presentation tactics pays. A developmental research perspective is needed in order to study whether good impressionists are really privileged as it was assumed [1]. Furthermore, it needs to be taken into account that due to a rather small sample size with an unequal group size of students from Austrian and Swiss schools, no hierarchical data analyses were conducted. It would be interesting to take class effects into account as well. Furthermore, the sample used for analysis was not randomly drawn but occasional which certainly is a limitation of the study. In addition, the instrument developed on the basis of the categories of Eder [14] took a rather limited view on impression management and primarily focused on acting as if. There is certainly a need to include other impression management strategies and also addressing strategies that do not aim at leaving a good impression and to ask for students' motivation. Despite some limitations and many open questions regarding student's impression management and self-presentation, this contribution offers theoretical as well as empirical hints and evidence for an in-depth discussion and reflection on further educational research topics:

- *Educational justice and equal opportunities*: IM could be discussed in addition to primary and secondary effects as another, tertiary, effect of social origin which shows to be important for school success. As [36] pointed out, these tertiary effects result from socially biased expectations, efforts and evaluations of the counterpart. Bourdieu [37] already stressed the importance of social capital and highlighted that "even manners (behaviour, ways of speaking, etc.) can be classified as social capital" (p. 191). This would mean that social origin would influence students' social understanding of social expectations and thus their IM which would not only affect teachers' perceptions and expectations but also their success at school.

- *Another perspective on successful teaching*: Success of teaching and any social interaction is also a question of whether the participants succeed in structurally coordinating their (subjective) situations and perspectives. Cultural guidelines such as school or class rules and rituals help to avoid constantly falling out of one's role and to save one's own face [13]. In this respect, it is important that all students know how to interpret these cultural guidelines and can adapt their behaviour accordingly. This is also linked to the question of educational justice and equal opportunities (see first point). Students understanding expectations and adapting to them in a positive way probably lead to less disturbances and disruptions of teaching and enhance teaching quality. Because teachers who constantly need to address students' behaviour have less time to focus on and deepen content of subjects.

Consequently, there are several important reasons why IM should be a topic that is integrated to teacher education. One the one hand, good teachers should strive to create equal opportunities for all students. It is, however, known that teachers' perceptions are influenced by factors not fully determined by students' performance and that these perceptions have an influence on students' school success. Successful IM may impair the diagnostic quality of the teacher's judgement and undermine the ideal of equal opportunities, especially if not all students are equally aware of the importance of IM and not equally competent in managing the impression to present the self in a good light. Teachers should therefore be able to reflect

not only their own perceptions and expectations they have of different students but also the students' impression management. Engaging into the topic of IM might also help teachers to identify students who are considered as non-privileged, who, for example, do not understand socially demanded expectations and do not know how they can adequately meet these expectations. It becomes possible to promote their social-emotional abilities in order to enable them to successfully manage their impression. Teachers can support students to learn to care about the impression they make and to help them understanding social expectations and rules in diverse settings. This is also important for individuals later in life, when they, for example, apply for positions and need to present themselves in a job interview. Reflecting on impression management during teacher education thus supports teachers in their pedagogical effort to create equal opportunities. On the other hand, impression management of students might, as discussed above, also contribute to teaching quality and has direct use not only for the teacher but the whole class. Understanding successful teaching as a "product" of all involved (see introductory remarks) points to the importance of IM. IM—as it was outlined in this paper—describes the effort to cast the self in a positive light. Students who aim to leave a good impression will therefore not involve themselves in disruptive behaviour. With regard to this other perspective on successful teaching, every teacher should care to have in his/her class as many students which are concerned about conveying a good impression (namely of being interested and motivated) as possible. In this context, it would also be important for teachers to address students' demotivation to present the self in a good light. Leary [17] emphasised that IM also serves emotional regulation, and Woods [28] highlighted that students usually know social rules and expectations. If students' consciously decide against a positive impression management, one reason could also be that students are addressed inappropriately by the teacher. Gao [38] speaks in this context of the student's decision to resist from learning from a teacher for reasons of self-protection. The knowledge and reflection about the impression management of students thus helps teachers to gain a greater understanding of social interaction processes in the classroom and supports them in reacting appropriately to (un)desired processes.

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Abbreviations

IM impression management
DV dependent variable

Appendix A

See **Table 6**.

Dimensions of impression management	Loading	Mean	SD
In my math class, ...			
Demonstrative engagement			
... I often put my hand up with the intention of making my teacher believe that I'm motivated.	0.92	2.66	1.01
... I actively take initiative with the intention of my teacher ascribing a high level of motivation to me.	0.92	2.66	0.91
... I often put my hand up with the intention of making my teacher think that I'm interested.	0.84	2.58	1.02
Self-promotion			
... even if I do not know the correct solution, I try to behave as if I know it.	0.87	2.38	0.98
... when many students put their hand up, I put my hand up too to make the teacher think that I know the answer even if this is not always true.	0.79	1.75	1.01
... I try to look as if I know the answer.	0.78	2.25	1.03
Situational adaptation			
... I do not let my disinterest show.	0.71	2.90	0.93
... I try to appear motivated even though I'm (sometimes) not motivated.	0.82	2.99	0.88
... I do not let it show that I'm not motivated.	0.76	2.74	0.93
... I behave as if I were interested in math.	0.71	2.82	0.91
... I behave as if I were motivated.	0.79	2.81	0.83
Personal adaptation			
... I sometimes fake interest because I want to leave a positive impression.	0.80	2.60	0.99
...I sometimes fake participation because I want my teacher to think that I'm a good student.	0.72	2.75	0.91
... I sometimes make my teacher believe that I have prepared myself for class even if it is not true.	0.56	2.39	0.99
... I sometimes fake motivation because I want to leave a positive impression.	0.82	2.53	0.92
Ingratiation			
... I pretend to fulfil my teacher's expectations.	0.79	2.74	0.90
... I pretend to follow my teacher's instructions.	0.76	2.61	0.94
... when my teacher explains what we are supposed to do, I pretend to find this important.	0.73	2.54	0.93

Table 6.
Item characteristic of the five IM dimensions.

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Author details

Sarah Forster-Heinzer[1*], Arvid Nagel[2] and Horst Biedermann[2]

1 Institute of Education, University of Zurich, Zurich, Switzerland

2 University of Teacher Education, St. Gallen, Switzerland

*Address all correspondence to: sarah.forster-heinzer@ife.uzh.ch

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Chapter 7

Students' Productive Struggles in Mathematics Learning

Anthony Sayster and Duncan Mhakure

Abstract

Using a predetermined framework on students' productive struggles, the purpose of this study is to explore high school students' productive struggles during the simplification of rational algebraic expressions in a high school mathematics classroom. This study is foregrounded in the anthropological theory of the didactic, and its central notion of a "praxeology" – a praxeology refers to the study of human action, based on the notion that humans engage in purposeful behavior of which the simplification of rational algebraic expressions is an example. The research methodology comprised a lesson study involving a sample of 28 students, and the productive struggle framework was used for data analysis. Findings show that the productive struggle framework is a useful tool that can be used to analyze students' thinking processes during the simplification of rational algebraic expressions. Further research is required on the roles that noticing and questioning can play for mathematics teachers to respond to and effectively support the students' struggles during teaching and learning.

Keywords: anthropological theory of the didactic, productive struggles, lesson study, mathematical teacher noticing

1. Introduction

The purpose of this study is to explore high school mathematics students' productive struggles during the simplification of rational algebraic expressions. In recent research in mathematics learning and teaching [1–3], struggle is often associated with negative meanings of how mathematics is practiced in classrooms. Teachers of mathematics often view students' struggles in mathematics as something that should be avoided and/or as a learning problem that needs to be diagnosed and remediated or simply eradicated [4, 5]. Struggle in mathematics learning and teaching is an essential component of students' intellectual growth, and of deep learning of mathematical concepts with understanding [6]. Research suggests that the apparent confusion and/or doubt displayed by students during problem- solving provide students with opportunities for deepening their conceptual understanding of mathematical concepts during teaching [7, 8]. However, exposing students to complex problem-solving tasks which are beyond their cognitive levels, skills and abilities can result in productive failures on the part of students [7]. When students engage in complex problem-solving tasks, they are likely to experience productive failure unless support structures are put in place. Broadly, support structure refers to "[re-] structuring the problem itself, scaffolding, instructional facilitation,

provision of tools, expert help, and so on" ([7], p. 524). Research has shown that exposing students to complex problem-solving without putting in place efficient support structures can result in an unproductive cognitive process [9, 10]. The notion of productive failure is centered on view that students are not in position to find the solution to a mathematical problem on their own in the short term. With assistance from teachers and capable peers, and taping from their prior knowledge, students can overcome their productive failures. Students can also experience unproductive success when they experience immediate learning gains through drill-and-practice, and memorization approaches. Unproductive failure learning situations arise when the conditions in a learning environment do not favor neither learning in short term nor long term. While there is no "recipe" in avoiding and/or addressing unproductive failure situations when students are engaging in complex tasks, for example – simplifying rational algebraic expressions, teachers can adopt approaches that ameliorate unproductive situations. According to [11] and others [12, 13], learners who engage in unguided problem solving are likely to experience productive failure. ([13], p. 128) posits that "What can be conceivably be gained by leaving the learner [student] to search for a solution when the search is usually very time consuming, may result in … no solution at all." Hence, to avoid unproductive failure learning situations, students must be provided with guidance during problem-solving. By guidance, we are referring to: scaffolding of problems; feedback through questioning, among others.

In other words, the struggle becomes a process in which students restructure their existing knowledge while moving towards a new understanding of what is being taught [14–16]. Students' struggles become productive in classrooms where they are afforded opportunities to solve complex problems, while being encouraged to try various approaches; even though in these classrooms, students can still fail and struggle, they will feel motivated and good about solving complex problems [17]. Equally, productive struggles ensue when students are given the support structure during problem-solving [7]. In classrooms, at the center of teaching and learning, teachers are expected to create a learning environment that values and promotes productive struggles among students by using challenging learning tasks that are nonetheless accessible to all students [18–21]. Productive struggle, which is stimulated by using challenging tasks during learning and teaching, supports students' cognitive growth and is essential for their learning of mathematics with understanding. While facilitating students' productive struggles teachers should avoid "reducing the cognitive load of the task such as [by] providing routine instructions tasks and over-modelling how to approach the task" ([17], p. 20). ([18], p. 178), similarly, encourages teachers to avoid "effortless achievement" by students; instead, teachers should value persistence and hard thinking.

While substantial research has been carried out on the types of errors that are committed by students when simplifying rational algebraic expressions in high school mathematics [22–24], this study explores the students' productive struggles during the simplification of rational algebraic expressions in real time, unlike the previous studies that focused only on students' errors. It is apropos to mention that students' productive struggles also include an understanding of how students deal with conceptual errors and misconceptions. As such, this study uses a predetermined framework [6] to analyze students' productive struggles as well as for analyzing the teachers' responses to the students' productive struggles. Existing research has focused on the difficulties encountered by students in understanding the equivalence of rational algebraic expressions through simplification and by valuing the importance of working and/or manipulating these expressions accurately with great flexibility [25–28]. The challenge here lies in the ability of students to work with more than one rational algebraic expressions and to find their

equivalences. Thus, to explore students' productive struggles during the simplification of rational algebraic expressions in high school, this study is guided by the following research questions: What are the types of productive struggles experienced by the students while simplifying rational algebraic expressions in a high school lesson? How do teachers notice, and respond to the students' productive struggles during classroom activities? What questioning techniques are used by the teachers to support the students' productive struggles?

2. Theoretical framework

In this section, we define the anthropological theory of the didactic – in which the study is based, and the students' productive struggle framework that is used for analyzing students' learning activities.

2.1 Anthropological theory of didactics

This study is founded in the anthropological theory of didactics and its central notion of a "praxeology" – a praxeology refers the study of human action, based on the notion that humans engage in purposeful behavior of which learning mathematics is an example [29, 30]. Nicaud et al. [28] argues that anthropological theory of the didactic as a general epistemological model for mathematical knowledge can be used to understand human mathematical activities, such as, in the context of this chapter, the simplification of rational algebraic expressions. Like any praxeology, the mathematical knowledge emerging from human activities is constituted by an amalgamation of four critical components, namely: type of task; technique; technology; and theory [28]. In human activities related to the learning of mathematics, Nicaud et al. [28] further re-classified the four critical components into two main praxeological models – the practical block and the knowledge block. The practical block is made up of the type of task and the technique. In the context of this study, the specific task is the simplification of rational algebraic expressions, whereas the technique refers to the tools that students need to carry out these simplifications. Examples of tools include: factorizations; finding common denominators, expanding expressions, and cancelation procedures among others. The knowledge block consists of a technology – which is used to explain the technique, and a theory – which is used to justify the technology. A point to be stressed here is that the word "technology" is used here to refer to a discourse on a given technique. In other words, "this discourse is supposed, at least in the best-case scenario, both to justify the technique as a valid way of performing tasks and throw light on the logic and workings of that technique" ([31], p. 2616). For instance, in this study, the technique is the "know how" to simplify the rational algebraic expressions, while the technology consists of what mathematical knowledge or logic justifies the way these techniques are operationalized.

At the core of ATD [29] is the notion of an epistemological model aimed at understanding the "ecology of mathematical knowledge that emerges from human practices" ([30], p. 1). Research shows that there many traditions of didactics at the core of teaching and learning in schools – the German Didaktik, whose origins hail from the seventeenth century, is one them [32, 33]. In general, the word "didaktik" refers to both the art of teaching, and to a theory of teaching. It is worthwhile noting that the German Didaktik does not cover subject areas issues but covers general issues of theory and practice of teaching [34]. However, the German Didaktik is guided by three core tenets: bildung; theory of educational content; and the notion of teaching as a meaningful endeavor which is encountered between students and

content [35–37]. The bildung – encapsulates the aims and values of the education system centered on "formation of the mind, the unfolding of capability, and the development of the sensitivity of the learner [student]" ([35], p. 544). In the German Didaktik, theory of educational content is construed as: the nature of content; educational value of the content; and the general organization of the content for educational purposes [38]. Also, at the core of German Didaktik, is the notion of "productive encounter" between content and students, which is analyzed and facilitated by teachers during teaching and learning [39, 40]. To provide context to this discussion between ATD and the German Didaktik, our position is that the German Didaktik is a general theory on the art of teaching and learning, while ATD seeks to address teaching and learning issues within a subject area – for example mathematics. In this study, the focus is exploring students' productive struggles when simplifying rational algebraic expressions. As such, the ATD with its praxeologies is used as theory for understanding how students conceptualize the simplification of rational algebraic expressions in mathematics.

2.2 Productive struggles

In the previous section, this study has alluded to the importance of students' struggle during learning activities on simplification of rational algebraic expressions and explained how this leads to overcoming conceptual difficulties and achieving deeper and more long-lasting learning [41]. Kapur [11] posits that, during productive struggles, a failed initial attempt on a certain task can lead to improved learning. This learning process envisioned by [11] occurs in two stages. Firstly, students are given a learning activity or problem they cannot solve immediately, and thus the teacher encourages them to conjecture on the possible solutions to the problem. Secondly, once the initial attempts have failed, students receive instruction on possible ways to solve the problem and are given another opportunity to try to solve the problem themselves. In other words, productive struggle "can prime students for subsequent instruction by making them more aware of their own knowledge gaps and more interested in filling those gaps" ([41], p. 85). Depending on individual students' levels of conceptual understanding, it is apropos to say that they experience different types of struggles. After observing these different types of productive struggles in a classroom situation when working on challenging problems, Warshauer [42] developed a productive struggle framework that consists of four types.

The main four types of productive struggles identified by [6, 16, 42] relate to the following aspects: getting started; carrying out a process; experiencing uncertainty in explaining and sense making; and expressing misconceptions and errors. **Table 1** shows the types students' productive struggles and their respective general descriptions [6, 16, 42].

The study uses the above four pre-determined types of students' productive struggles as a framework for analyzing students' ways of simplifying rational algebraic expressions.

2.3 Responses to productive struggles

The construct of "noticing" in mathematics teaching is a widely researched phenomenon in mathematics education, particularly in the high school context [43–45]. Mathematical noticing or simply noticing during teaching consists of three interrelated skills: "*attending* to children's [students'] strategies, *interpreting* children [students'] understandings, and *deciding* how to respond based on children's [students'] understandings" ([45], p. 117). Huang and Li [46] further elaborates on this, positing

Type of productive struggle	Description of the productive struggle
Getting started	Students feel cognitively overloaded and confused about the task – this is evidenced by the fact that there are no written answers or attempts on paper. Students also claim that they do not remember the work and/or the type of problems, and there could be gestures of uncertainty, and resignation. As a sign of frustration, students' utterances could be: "I do not know what to do," "Oh dear! I am very confused," "I wish I knew where to start," etc. In term of simplifying rational algebraic expressions, students might not fully understand the illustration from the question.
Carrying out a process	This relates to students encountering an impasse while attempting to solve a given task. For example, students may find it difficult to demonstrate or follow a known procedure or algorithm. Also, students may fail to recall the facts or formulae required to successfully implement a process, such as factorizations, multiplication of factors, or division of factors required to obtain an equivalent fraction.
Experiencing uncertainty in explaining and sense-making	Students may find it difficult to explain their work to other members of the group, when working in small groups, or to the whole class, when asked to do so by the teacher. In many cases, students fail to verbalize their thinking processes or to justify their correct answers. For example, the student may say "I know this is the correct simplification, but I cannot explain how I got it."
Expressing misconception and errors	Errors can be classified as: careless and conceptual. On one hand, conceptual errors occur when students fail to observe the correct relational ideas when solving problems. On the other hand, careless errors relate to unintentional and yet avoidable procedures that students commit during problem solving. A misconception is usually not wrong thinking; however, it can be interpreted as an indication of deep-seated misplaced ideas that are used to justify the process of finding a solution to a problem – these can manifest as local generalizations made by students.

Table 1.
Types of students' productive struggles and their descriptions.

that *attending* is also about identifying what is noteworthy, that *interpreting* is about making general connections between specific classroom interactions and broader theories of teaching and learning, and that *deciding* is also about how teachers use what they know and understand about their learning contexts to decide how to respond or reason about classroom activities. Teachers use the construct of noticing to identify students' productive struggles. Once the students' struggles have been identified, the teachers will make intentional efforts to support these struggles – in this context, the simplification of rational algebraic expressions. In other words, supporting students' productive struggles requires the teacher to find ways of addressing or responding to the struggles by converting them into positive learning endeavors that create further opportunities for deep learning, rather than episodes in which learners experience difficulties and frustration [4, 6, 16]. Recent studies have illustrated many possible ways teachers can use to respond to the students' productive struggles in mathematics [4–6, 47] - these ways are not mutually exclusive.

Teachers mainly respond to the students' productive struggles in the following four ways: Firstly, they can use *telling* – in other words, after evaluating the nature of the students' productive struggles, a teacher can help a student by: suggesting new approaches to solve the problem; directly correcting the student's errors and/or misconceptions; and giving the student a simpler problem to work on first. [48, 49] stress the notion of "judicious telling," which requires teachers to support students'

productive struggles by repeating the students' own contributions with the aim of highlighting the mathematical ideas that students have already grasped and understood to enable students to better understand the contexts and terminology in the specific tasks. Secondly, teachers can utilize *directed guidance*, which involves the teacher breaking down the problem given to the student into manageable parts, which can assist him/her to anticipate the next step in solving the problem. Directed guidance can also be used, as in this study, for instance, to allow a student to do operations on numerical fractions before he/she attempts simplifications of rational algebraic expressions. Teachers can also use "advancing questions," which can "extend students' current mathematical thinking towards a mathematical goal (simplifications of rational algebraic expressions) of a lesson" ([47], p. 178). Thirdly, teachers could use *probing guidance*, in which the teacher assesses the student's thinking by asking him/her to justify and explain his/her proposed solution. This is done by asking assessing questions and advancing questions (as explained above). Asking assessing questions allows the teacher: to discover students' thinking processes, evaluate their cognitive capabilities, and encourage them to share their thinking on the simplification of rational algebraic expressions [47]. Lastly, teachers can use *affordance*, which involves the teacher's ability to engage students by emphasizing justifications and sense-making with the entire group or with individuals. The term also refers to affording the students time and space to think and solve the problem with encouragement from the teacher but with minimum help. By using these four ways to respond to students' productive struggles, and teachers are afforded the opportunity to deepen their own understanding and more appropriately access students' thinking processes, while positioning themselves to effectively support students' learning – in this case, their learning on the simplifications of rational algebraic expressions. The teachers' questioning techniques will allow the teachers to deepen his/her understanding of the nature of the struggles students harbor.

As already alluded to in this chapter, support structures need to be put in place to ameliorate situations where students' productive struggles can be obstacles for student learning or barriers to students' conceptual development in mathematics [7]. In addition, where students struggle as expected during learning, it is apropos for teachers not to rush to provide a support structure, but to wait until students reach an impasse – as evidenced by utterances such as "I am stuck,", and "I have no idea on how to proceed," among others. By extension, support structures can also refer to questioning techniques of teachers, teacher explanations, or feedback in real time on students' work. It is worthwhile noting that a delayed support structure, for instance – teacher's explanation, can lead to performance failure in the short term, but in the longer term benefits the student as it gives the student time to discern the concepts of the problems being solved.

3. Methodology

In this section, we describe the research sample within the context of the study, the lesson study as a research methodology, and the data sources and analysis techniques.

3.1 Participants

This study sought to explore Grade 11 mathematics students' productive struggles during simplification of rational algebraic expression, and the ways in which the teacher noticed, and responded in a high school located in South Carolina in the

United States of America. Twenty-eight students participated, constituting all Grade 11 students at the high school. Since the study involved minors, ethical clearance was sought from the South Carolina County School District, the school principal, and the legal guardians of the students. In addition, consent was also sought from the participating teacher who was responsible for teaching the concept of simplification of rational algebraic expressions.

3.2 Data sources

In this study, data was collected by using a pre-determined research instrument, in other words, a lesson on the simplification of rational algebraic expressions, which was co-planned and co-implemented by the teacher and the researchers. The lesson which is the subject of investigation is part of a series of lessons that were taught on the simplifications of rational algebraic expressions. To be more precise it is the third lesson of the series lessons. Lesson 1 dealt with simplification of rationale algebraic expressions of the form: $\frac{2}{ab} + \frac{5}{bd}$. Lesson 2 dealt with the simplification of single rational algebraic expressions where factorization was envisaged, for example: $\frac{2x-6}{x^2-9}$. Lesson 3, which is the focus of this study, deals with the simplification of two rationale algebraic expressions being added or subtracted, for example, $\frac{x}{x^2+x-2} - \frac{2}{x^2-5x+4}$, where factorization and finding common denominators are envisaged. All the problem solved by students during the three lessons outlined are foregrounded in the South African Grade 11 mathematics syllabus and come from a prescribed textbook that students used.

This study uses a lesson plan as research methodology with specific focus on exploring the types of productive struggles students experienced during the simplification of rational algebraic expressions. While the stages of the lesson study of setting goals and planning are given less prominence in the data analyses, they are nonetheless important because they foreground the activities of the implementation and debriefing stages. Since the students' productive struggles manifest during the implementation stage of the lesson study, the study has prioritized the implementation stage to explore the students' productive struggles. The debriefing stage affords the teacher the opportunity to discuss with the researcher the students' productive struggles as he observed and responded to them in class, and in real time.

Research studies position the lesson study, which originated from East Asia, as a form of practice-based continuous professional development of mathematics teachers, which has since been adopted by many other countries [50]. In each of these countries, the emphasis of the lesson study varies, however, its major role of school-based continuous professional development for mathematics teachers remain. For example, in China, the focus is on "developing best teaching strategies for specific subject content for student learning," and in Japan, the focus is on "general and long-term educational goals, such as developing students' mathematical thinking through observing student learning in order to collect evidence to improve it" ([51], p. 271). Regardless of the country, the lesson study has three salient features, it is: a deliberate practice – meaning that the task of a lesson study is goal-oriented aimed at improving teacher performance, and affords opportunities for repetition and refinement; a research methodology – aimed at improving both professional and academic knowledge; and an improvement science – through the use of "plan-do-study-act" ([52], p. 54) innovations. In this study, we chose the lesson study as a research methodology to explore the students' productive struggles when simplifying rational algebraic expressions over the design-based research methodology. The lesson study, as a deliberate practice and research methodology can be used in a similar way as the design-based research to narrow the gap between research and practice during

teaching [51–53]. Proponents of the lesson study argue that "not only is this (lesson study) real research, but the methodology of lesson study has huge benefits as means of developing knowledge that is useful for improving teaching (and learning)" ([54], p. 584). As a research methodology, the lesson study, seeks to address specific research questions using a research lesson – a research lesson is a lesson that is a subject of an investigation by researchers. A case in point here is the simplification of rational algebraic expressions. When using the lesson study as a research methodology, the research lesson is often proceeded by an evaluation of the students' conceptual understandings of concepts taught – this can be done through documentary analysis of students' written work in tests and/or carrying out focus group interviews with students who participated in the research lesson.

Data collection processes were informed by the stages of a lesson study approach [55]. Moreover, all the stages were video-recorded. The lesson study was thus used in this study as the research methodology [51], as this allowed both teacher and researchers to study students' thinking [47, 51]. In the context of this study, the lesson study consisted of four stages. The first involved *setting goals* by identifying specific students' learning and development goals and achievements, as agreed upon beforehand by the teacher and the researchers, pertaining to the simplification of rational algebraic expressions. The second stage was *planning*, which meant using the goals identified to plan a "research lesson" that would be used for data collection on the topic. During this stage, discussions took place on how to anticipate students' questions and the teacher's responses. During the third stage, *implementing*, the teacher taught the class, while the researchers observed and collected the data. Focus group interviews took place with the students, who were given opportunities to explain their understanding of the lesson topic. In the final stage, *debriefing*, the teacher and the researchers met to discuss and/or reflect on the data collected; samples of students' work that had been collected were also analyzed to validate some of their productive struggles during the lesson [51, 55–57].

3.3 Data analysis

Video-recordings of the classroom interactions during the research lesson and focus group interviews for students were transcribed verbatim. Thereafter, the transcriptions were analyzed using a pre-determined productive struggles framework (see **Table 1**) thus exploring the types of students' productive struggles encountered and the teachers' responses to these. In addition, documentary analysis was used to analyze students' written work to see how they were simplifying rational algebraic expressions.

4. Findings and discussion

In this section, a pre-determined framework (see **Table 1**) is used to explore the types of struggles experienced by the high school students, and the ways in which the teacher noticed and responded to these are discussed from examples given within a lesson situation. To be more specific during the implementation stage of the lesson study. For anonymity, the letters T and S represent the teacher and student respectively. The word episode is used to refer to a lesson excerpt.

4.1 Getting started

Below is an excerpt that describes the classroom interactions between the teacher and the students when the students were asked to simplify two rational

algebraic expressions: $\frac{2}{x^2-x-2} - \frac{6}{x^2+6x+5}$. Prior to this lesson, students had been simplifying single rational algebraic expressions that require factorization – students were expected to factorize the numerator and denominator, and then perform a cancelation. However, in this episode from the lesson, the simplification of rational algebraic expressions was extended sums and differences of two rational algebraic expressions which required factorization.

Learning episode 1.

S: I am stuck.

T: Sweet, I am on my way. Where are you stuck?

S: I factored it, and this is what I got $\frac{2}{(x-2)(x+1)} - \frac{6}{(x+5)(x+1)}$.

T: Alright. What are you going to do?

S: I've got to make them [*the denominators*] the same.

T: Ok what do you have to do to make them the same? [*Teacher notices that the students are struggling]*

T: What factors are common in denominators of both fractions? [*sensing that there might be an overall conceptual problem in the class by listening to students' chit chat*]. Hey guys, let us back up. Are sure you know what going on [*referring to the last student*]? Alright, we are going to revisit the problem we did yesterday:$\frac{2}{3x} + \frac{2}{7x^2} - \frac{3}{2xy^2}$, which we expanded to: $\frac{2}{3x} + \frac{2}{7xx} - \frac{3}{2xyy}$

At the beginning of the episode, a student remarked that he/she was stuck – meaning that they could not initiate the simplification the rational algebraic expression. The teacher used probing guidance, by asking questions, such as *Where are you stuck? … What are you going to do?* This prompted the student to explain his/her thinking processes to the teacher. While listening to the students chatting, the teacher noticed that they were experiencing challenges of simplifying rational algebraic expressions' particularly the factorization. From an ATD perspective, some students lacked the technique or the tools such as factorizations to simplify the rational algebraic expressions [29, 31]. In responding to this productive struggle, the teacher decided, together with the students, to revisit a much simpler example they had done the previous day. The teacher's action constituted directed guidance by redirecting the students' attention to a much simpler example with the aim of trying to deepen their understanding of the related concepts. In the debriefing interview, the teacher referred to the *get started* stage as a "freak out" moment, positing, "I definitely think there was a get out there and a freak out moment and they don't understand anything." He continued to say that, whenever his students were stuck, he reminded them to calm down and think about the concepts they had already covered and to try to apply them to the novel problem. Intuitively, the teacher alludes to the notion of *delay of structure* [7] – this notion is about a teacher delaying, giving a student a support structure, for example, in the form questions, explanations or feedback, immediately when the student experiences an impasse [58, 59].

4.2 Carrying out a process

In another episode during a lesson, the students were tasked with simplifying the following two rational algebraic expressions: $\frac{x^2-7x+23}{x^2-36} + \frac{6x-19}{36-x^2}$. The student in question did nearly all the work correctly but failed to factorize the last step – this work was done on the board during the lesson. As the student was busy simplifying the rational algebraic expressions, he/she came to an impasse and failed to reduce the final rational algebraic expression. In this excerpt, S represents a student working the problem on the board, while C_1, C_2, and C_3 are other students in the class. While S was simplifying the rational algebraic fraction on the board, the other students (C_1, C_2, and C_3) were comparing their own solutions to that of S.

Learning episode 2.

S: $\frac{x^2-7x+23}{x^2-36}+\frac{6x-19}{36-x^2}=\frac{x^2-7x+23}{x^2-36}+-\left(\frac{6x-19}{36-x^2}\right)$

[The student tries to use the notion that $(x-y)=-(y-x)$ having noticed that (x^2-36) and $(36-x^2)$ exhibit a similar trait – the student's work was written on the board].

S: $\frac{x^2-7x+23}{x^2-36}+\frac{6x-19}{36-x^2}=\frac{x^2-7x+23}{x^2-36}+-\left(\frac{6x-19}{36-x^2}\right)=\frac{x^2-7x+23}{(x+6)(x-6)}+\frac{-6x+19}{(x+6)(x-6)}=\frac{x^2-13x+42}{(x+6)(x-6)}$

S: I am stuck [*the student fails to recognize that the numerator of the last fraction can be factored as* $(x-6)(x-7)$ *and the fraction would consequently reduce to* $\frac{x-7}{x+6}$]

C_1: That is not what I got, teacher [*C_1 seeks to help S*].

C_2: We did the other side, teacher, we got +13 and − 42. *The classmate alludes to the fact that he multiplied* $\frac{x^2-7x+23}{x^2-36}$ *by negative one to get* $\frac{-\left(x^2+7x-23\right)}{(36-x^2)}=\frac{-x^2+7x-23}{(6+x)(6-x)}$

$\frac{-x^2+7x-23}{(6+x)(6-x)}+\frac{6x-19}{(6+x)(6-x)}=\frac{-x^2+13x-42}{(6+x)(6-x)}$.

C_3: Factor out the top [*the numerator*] and then you can cross [*cancel with denominator*] out.

S: $\frac{x^2-13x+42}{(x+6)(x-6)}=\frac{(x-7)(x-6)}{(x+6)(x-6)}=\frac{(x-7)}{(x+6)}$.

The classroom interactions in this episode were student–student interactions, where the teacher did not participate in the simplifications of the algebraic rational expression. When the student working at the board encountered an impasse, he/she said, "*I am stuck*" – thus calling for help. In this episode, the teacher did not comment or respond; instead, one of the students did so, stating, "That is not what I got, teacher." By not responding immediately to the students' classroom interactions, the teacher was using the affordance technique – where students were afforded the space and time to think through and solve the problem with the teachers' encouragement but with minimum help [49]. In this kind of approach, students are encouraged to use other students' thinking processes as resources to simplify rational algebraic expressions; for instance, student (C_2) suggested an alternative step of writing the expression $-x^2+13x-42$ instead of $x^2-13x+42$. Having noticed that the student at the board (S) needed help in simplifying the rational algebraic fraction, a fellow student (C_3) told him/her how to proceed: "factor out the top [the numerator] and then you can cross [cancel with denominator] out." Finally, with this assistance, student (S) was able to simplify the algebraic rational expression successfully.

During the debriefing interview, the teacher alluded to the fact that some students failed to carry out a procedure: "the main thing with today's lesson was about finding the common denominator … but I think other than that they got it pretty good." Interestingly, when asked about why he/she did not respond or comment on the students' interactions, the teacher said, "it is one way that I use to create an interactive and engaging learning environment among students during the lesson." In addition, the teacher was concerned that, as the problems would become more complex in subsequent lessons, his students were likely to struggle with identifying common denominators.

4.3 Experiencing uncertainty in explaining and sense-making

In the next episode, the focus is on how a student simplified two rational algebraic expressions:

$\frac{x+4}{x^2+15x+56}+\frac{6}{x^2+16x+63}$ on the board.

Using this example, we illustrate how a student found it difficult to verbalize his/her thinking processes and failed to justify his/her answers even though they were correct.

Learning episode 3.

S: I am going to factorize the two denominators $(x+7)(x+8)$ and $(x+9)(x+7)$

T: Ok, what are you going to do now? Ok, I understand that you factored the bottom [*denominator*]. So, what do you think comes next?

S: I will multiply $\frac{(x+4)(x+9)}{(x+7)(x+8)(x+9)} + \frac{6(x+9)}{(x+8)(x+7)(x+9)}$

T: Why did you put $(x+9)$ there? Why did you write $(x+9)$ on the left? [*student shrugging his shoulders to indicate he does not know why he/she wrote what he wrote*]

T: [*sensing the uncertainty*] ... What is our goal now? What are we trying to accomplish? Before we add those on top [*numerators*] what do we need to have?

S: Common factor?

T: Close. We must have a common what?

S: Denominator.

In this episode, while the student was using the correct method, there came a point where he/she could not explain and/or verbalize his/her strategy for simplifying the problem. For example, when asked by the teacher why he/she had multiplied both fractions by the factor $(x+9)$, the student could not answer, but instead shrugged his/her shoulder as a way of saying "I do not know." When the teacher sensed this uncertainty, he responded by asking probing questions to guide the student towards achieving the goal of the question – "why did you put $(x+9)$ there?" The teacher wants to get to a point where the student says that he/she wants to find a common denominator between the two rational algebraic expressions.

During the interview with the teacher, he remarked that uncertainty was also expressed through the student's unwillingness to go to the board to work out the problems given to the class. The teacher said, "I really like to see the people that are struggling more at the board," and that he would like to hear more students saying, "I don't know what I am doing, but I am going up there" – the teacher acknowledges that the latter is a challenge which he/she hopes could be resolved by exposing students to more practice questions.

4.4 Expressing misconceptions and errors

In this section, we discuss the types of errors that manifested in the students' written work in learning episodes 1, 2, and 3 above. **Figure 1** below shows a student's conceptual error that was committed when simplifying the rational algebraic expression in learning episode 1.

Figure 1 reveals that although the student completed the question, he/she committed a conceptual error by making both denominators the same by observing that the first denominator had a "-2" and the second denominator had a "5" – the numbers "2" and "5" are the independent variables of the two denominators of the fractions to be simplified – the student ignored the "minus" sign for "2," opting instead to use a positive "2." In other words, the student seems to have ignored the letters and reduced the rational algebraic expressions into simple numerical fractions [23, 24]. The student, however, succeeded in simplifying his/her own numerical fractions from $-\frac{4}{20}$ to $-\frac{1}{5}$ [58].

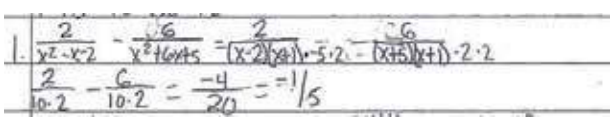

Figure 1.
An example of a student's conceptual error from learning episode 1.

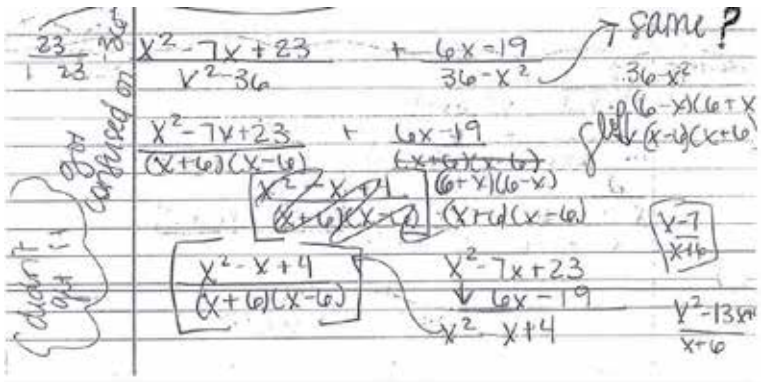

Figure 2.
An example of a student's misconception from learning episode 2.

In **Figure 2**, the student did not realize that $x^2 - 36 = -(36 - x^2)$ or more generally that $(a - b) = -(b - a)$, and thus had a misconception that the two denominators from both rational algebraic expressions were the same. This misconception resulted in the student not being able to simplify the resulting rational algebraic expression, because he/she could not factorize its numerator – in fact, the numerator cannot be factorized, hence the cancelation between the numerator and denominator cannot be done.

In **Figure 3**, the student committed an error by forgetting to follow through the multiplication of the numerator and denominator of the first and second fractions by $(x + 9)$ and $(x + 8)$ respectively – as a result the student had incorrect numerators and could not simplify the two rational algebraic expression.

4.5 Limitations

This study is based on a very small sample of 28 Grade 11 mathematics students in one school from a county. It is not the intention of the authors to draw upon any generalizations on the students' productive struggles on the simplifications of rational algebraic expressions from the small sample used in the study. Ii is our contention, that some of the observations made on the students' productive struggles are attributed to sample of 28 Grade 11 students who participated, their mathematical skills and abilities on the topic under discussion. As such, this study merely highlights some of the potential productive struggles that students are likely to encounter when solving problems on the simplifications of rational algebraic expressions. In a way the study can be used to give directions on the future research

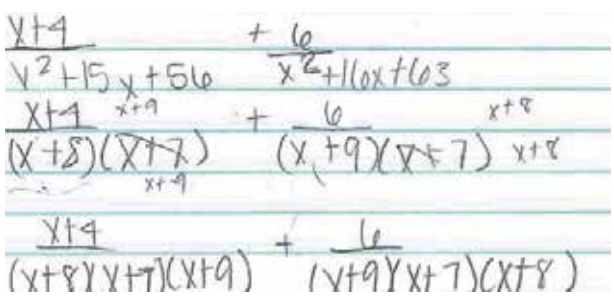

Figure 3.
An example of the student's error from learning episode 3.

work on students' productive struggles, mathematics teachers noticing and questioning techniques during lessons.

4.6 Instructional implications

Given the limitations of the study – the use of a single and small study, we are cautious about drawing generalized instructional implications that can be drawn from this study. Having said that, we believe that the study can highlight issues related to: struggle, support structures, and delay structure. Struggle – often struggle in mathematics is viewed as something negative, however, this study construes struggle as something essential for the student's intellectual growth, and a necessity which used during mathematics lessons. Support structures – during problem solving the role of support structures during learning in the form of feedback, questions, scaffolding questions, among others, is critical for students learning. Delay of structure - an important instructional implication here is that the role of delay of structure when students reach an impasse opens-up opportunity for learning – where there is no impasse, despite rigorous support structure provision, learning is not guaranteed [7].

5. Conclusion

In this chapter, our aim was to explore students' productive struggles on the simplifications of rational algebraic expressions, and of how teachers notice and respond to these productive struggles. Using the pre-determined productive struggle framework developed by Warshauer [42], we were able to identify and categorize the types of productive struggles that students experienced in the classroom and to look at the different ways in which the teacher addressed these struggles. Throughout the paper, it was not our intention to deal with constructs of noticing and questioning separately, but rather to discuss them within the types of productive struggles. In addition, the types of errors discussed in this paper are not exhaustive [23, 24], since they only pertain to the problems discussed in learning episodes 1, 2, and 3.

In conclusion, while this study contributes to the mathematics classroom discourses on the students' productive struggles on the simplification of rational algebraic expressions, using a bigger sample, further research is required on: the roles that mathematical teachers' noticing and questioning can play, and on how teachers respond to and effectively provide support structures to students' productive struggles during the teaching and learning of specific mathematics concepts.

Author details

Anthony Sayster and Duncan Mhakure*
Centre for Higher Education Development, University of Cape Town, South Africa

*Address all correspondence to: duncan.mhakure@uct.ac.za

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Chapter 8

Perception of Student-Teachers Regarding Self-Regulated Learning

Carolina Zambrano-Matamala, Darío Rojas-Diaz, Pedro Salcedo-Lagos, Felipe Albarran-Torres and Alejandro Diaz-Mujica

Abstract

In this chapter of the book we have described and analyzed what student-teachers understand by self-regulated learning, what they do when applying the different phases of this process and what are the difficulties, they have to regulate their learning. Student-teachers participating in the study are pre-service teachers who are trained to work in the school system as secondary school teachers. The sample consisted of 60 student-teachers from a university in southern Chile. The main findings show that students relate the concept of self-regulated learning mainly with the general organization prior to the study and with the regulation of their emotions. Regarding the process of self-regulated learning, it is suggested that the planning and execution phase are incipient because there is: (i) lack of strategic planning in the planning phase, (ii) lack of motivational self-control processes, which influences the lack of regulation as: disorganization and uncontrolled emotions, (iii) absence of self-records that allow them to compare and monitor the execution of the study. Additionally, it is proposed conceptual model includes components that represent: (i) the understanding of the concept of self-regulation of learning, (ii) development of the process of self-regulation of learning, (iii) lack of regulation and (iv) external agent's antiregulation of learning.

Keywords: self-regulated learning, student-teachers, lack of regulation, study planning, learning process, agents antiregulation of learning

1. Introduction

The Chilean educational system has undergone a process of expansion and transformation of higher education, which has generated a massive entry of students that produces, among other consequences, student desertion, mainly due to the fact that these students fail to adapt to the demands of university life. In this sense, authors such as [9] have studied the evolution of the educational system in Chile through the processes changes of supply and demand, whose results reflect how this phenomenon has led to the need to generate strategies oriented to the retention of students in the different universities. In addition, another factor that has influenced the higher education system corresponds to the growing positioning of the competency-based approach that has been promoted by international entities, such as the World Bank,

the Organization for Economic Co-operation and Development (OECD), the Ibero-American Bank, and the European influence of the Bologna Process [10]. Thus, in this scenario of massive student access to higher education and the focus on skills in university curricula is that autonomy capacity is required in university students, which consequently leads to the need to understand and evaluate how students self-regulate their learning [7, 8, 27]. From the previous background, the following question is relevant: why is self-regulated learning important? Because it is a psychological construct that has been studied in various researches, proving that it is a predictor of academic achievement [3, 31]. Therefore, it is a factor that allows institutions to develop curricular policies and accommodations that decrease student desertion.

In the case of student teacher, self-regulative learning skills are extremely important contributors because student teacher double role in his training: (i) "the teacher as a subject who learns" and (ii) " the teacher in the function of teaching to learn" [6]. Likewise, it is important to point out that from the perspective of the twenty-first century skills [32] the possibility of knowing student-teachers understand the concept of self-regulated learning and how they describe applying the process of self-regulated learning. Studying the ability to learn to learn [32] from the self-regulated learning is based on the fact that future teachers will be the ones who can promote this type of learning in the classroom to their students to foster in them the necessary skills in the society where they will develop. Student-teachers participating in the study are pre-service teachers who are trained to work in the school system as secondary school teachers.

Another motivation to carry out the research is related to the incipient amount of research on the subject in student-teachers in Latin America. A situation that is evidenced in the systematic review conducted by Hernandez and Camargo [19] who report that between 2005 and 2015 only 7 articles were published in Latin America where the participants are student-teachers. In this sense, we find three investigations in Latin America that focus on student-teachers using the qualitative approach to describe through case studies the process of self-regulation of learning [13, 26, 29]. However, none of the previous studies has been done with student-teachers in Chile. On the other hand, in the European context, in Finland, we find the following studies related to self-regulative learning skills in student-teachers [38–40].

Additionally, it is important to indicate that student-teachers need self-regulation skills in their training as teachers and in their role as students in order to learn to reflect on their own learning process. In this way, it is essential for student-teachers to understand the concept of self-regulation of learning and the stages of the process of self-regulation of learning so that when performing their work in the classroom they can design interventions that promote self-regulation of learning in their students [38]. In this sense, it has been suggested that for a teacher to be strategic in encouraging self-regulated learning in the classroom, he must first have been a self-regulated student during his training as a teacher [6].

This chapter gives an account of the results of a preliminary investigation, of a descriptive type, that addresses the perception that a group of student-teachers has of the concept of self-regulation of learning and the process of self-regulation of learning. In effect, the research aims to analyze and describe what student-teachers understand by the concept of self-regulation of learning, what they do when applying the different phases of this process and describe what are the difficulties, they have in carrying out this process. A conceptual model that represents the understanding of student-teachers regarding the self-regulation of learning is also presented. In this sense, it is important to point out that the pedagogy students' understanding of self-regulation of learning, incorporates different perspectives from four dimensions: (i) the understanding of the concept of self-regulation of learning, (ii) development of the process of self-regulation of learning, (iii)

difficulties to regulate their learning named lack of regulation and (iv) anti-regulation agents of learning.

Next, two sections are presented, one to explain self-regulation of learning and the cyclic process of self-regulation and then a section of self-regulated learning in teacher training.

1.1 Self-regulated learning

In general terms, the self-regulation of learning is defined as: the control that the subject carries out over his thoughts, actions, emotions and motivation using strategies that allow him to reach the objectives that he has established [24].

In the field of research on self-regulated learning, several models are distinguished. Six were analyzed in [23] and are the models of [2, 11, 17, 25, 31, 35]. In this research uses the Zimmerman model in its latest version [37] because this model has been the most widespread in the scientific literature in the field of educational psychology [24] and to include a process of cyclical self-regulation that explains in detail in the 2009 version. In this version, it is detailed the three phases of self-regulated learning that can be considered as an "ideal process" with which to contrast the perceptions of teachers-students regarding this process. The three phases of the model proposed in [37] are explained:

Planning Phase: it is the initial phase that is made up of the process of "Analysis of the task and the self-motivating Beliefs". For example, when a student faces a task for the first time, he/she should carry out two processes: (1) to establish the objectives to be achieved and (2) to perform strategic planning. These two processes allow carrying out the analysis of the task. In the case of self-motivating beliefs, it is established that five types of variables influence: (1) self-efficacy, (2) result expectations, (3) task value, (4) interest and (5) goal orientation. These variables are personal and allow generating the motivation to carry out the activity.

Execution phase: it consists of two processes: (1) self-control and (2) self-observation. The first is defined as the process to maintain concentration and interest through metacognitive or motivational type strategies. On the one hand, metacognitive self-control is established by choosing a specific strategy, for example, when making a summary. On the other hand, motivational self-control refers to encouraging interest, for example, by using reminder messages about the goal. The second process is defined as the comparison between what is being done with respect to an ideal execution model.

Self-reflection phase: this phase is composed of the self-judgment process and the self-reaction process, which interact with each other. On one hand, self-judgment is the process that allows the student to judge his execution. In this way, the student can perform a self-assessment that allows them to assess his/her work, based on the quality criteria that should have been clearly established at the beginning of the activity by the teacher. Also, the student will perform causal attributions that imply how self-explains success or failure in the activity. On the other hand, the process of self-reaction refers to the student's reactions to their self-judgments. Thus, their self-reaction can be of satisfaction, affection, adaptation or a defensive reaction.

1.2 Self-regulated learning in teacher training

Teacher training has focused on teaching specific disciplinary content to some area [6, 14]. In addition, teaching in the classroom has been based on the role of the teacher as an exhibitor, who in this context usually applies expository, masterly or theoretical classes to convey the disciplinary content that he acquired in his training as a teacher [6]. Therefore, research evidence in the field of self-regulation of learning in pre-service teacher training is low in Latin America [19] and especially in Chile.

In this context, we agree with [5] who point out that one of the reasons is the lack of dissemination of theories and/or models of self-regulated learning in teacher training.

Likewise, research findings in Finland show that self-regulative learning skills are extremely important contributors in student teacher learning [38–40]. Another aspect that has been studied and that may be related to the self-regulation of learning and the training of student-teachers is the importance of thinking about their double role, is to say "the teacher as a subject who learns" and " the teacher in the function of teaching to learn" [6]. Therefore, student-teachers require to know and understand the concept, theories and models of self-regulation of learning. Also, they need experiential knowledge about promoting self-regulation of learning.

The theoretical knowledge about the theories and/or models of self-regulation of learning is important for the students of pedagogy because it allows them to know and understand the concept of self-regulation of learning from different perspectives. With this theoretical knowledge the students of pedagogy may have "awareness of the importance of self-regulation of learning" to later perform actions that allow them to adjust their thoughts and/or actions and/or emotions and/or motivation to self-regulate their learning. In addition, they will be able to understand why they have difficulties or deficiencies to self-regulate their learning [6, 39].

The experiential knowledge about self-regulation of learning would help to train the teacher as a subject who teaches how to learn. Because he could apply systematic interventions or case studies in the classroom that include one or some aspects of self-regulation of learning [33].

From the previous background, this chapter analyzes and describes what student-teachers understand by self-regulation of learning, what they do when applying the different phases of this process and what difficulties they have in carrying out this process.

2. Method

To carry out this research and understand the perceptions of a group of student-teachers regarding the concept of self-regulated learning, the process of self-regulated learning and it difficult to regulate their learning. The qualitative research approach was used according to [18] through a case study. Student-teachers participating in the study are pre-service teachers who are trained to work in the school system as secondary school teachers. Our interest is student teachers' understanding of self-regulated learning, and how they themselves regulate their own learning. We opted for the interview method because it is a technique that allows a conversation on topics that are complex. In addition, the characteristic of the group interview is that as a group instrument it is more than the sum of its parts according to [28]. This allows participating subjects to reinforce ideas that are complex to transmit in individual interviews.

2.1 Research design

The design is non-experimental descriptive cross type, that is, it aims to categorize and provide a view of the phenomenon under study.

2.2 Research questions

The questions formulated to guide the investigation were:

1. What do (student-teachers) understand about the concept of self-regulated learning?

2. What do (student-teachers) describe about the different phases of the process of self-regulated learning from the perspective of the Zimmerman model?

3. What are (student-teachers) the difficulties in regulating their learning?

2.3 Participants

For the selection of the sample, the non-probabilistic sampling technique was considered, given that the participants were selected intentionally. The criteria for the selection were:

a. being in second, third or fourth year of pedagogy and

b. voluntarily participate in the study.

Six group interviews were conducted with pedagogy students. Each group was composed of 10 subjects. Thus, the sample was constituted by 63% of people of female students and 37% of male students. The subjects' age ranges between 19 and 27 years with an average of 20.3 years and standard deviation of 2.5 years. The total sample was 60 subjects. It should be noted that participating students have not had a degree of prior contact with respect to the concept of self-regulated learning.

2.4 Process

The procedure consisted of applying the group interviews in groups of 10 students in a classroom. Before starting the group interview, the students were told that there would be no debate or interaction between them, but only the response of each one was expected independently. In this way, the question was asked, and each student responded in turn to the question. Each group interview was recorded and then transcribed.

2.5 Instruments and procedure of data analysis

To collect the information, a set of questions was generated and applied in each of the group interviews according to the procedure described above. The questions applied to the students in the group interviews are:

1. What do (student-teachers) you understand by self-regulation of learning?

2. How do (student-teachers) you plan your study?

3. How do (student-teachers) you study?

4. How do (student-teachers) you verify if they are doing well and/or properly their learning?

5. How do (student-teachers) identify or specify what they should learn?

6. If you have obtained poor results, what actions do (student-teachers) you take to study better?

7. What difficulties do (student-teachers) you have when you are ready to study and during your study?

Six group interviews were conducted where participants answered the questions without interacting with each other, nor generated debate. The questions that were applied in the group interviews focused on the following dimensions: (1) concept of self-regulated learning, (2) phases of the process of self-regulated learning according to the Zimmerman model and (3) difficulties in the self-regulation process. The information collected was transcribed and processed using the QDA Miner software in its free version v1.4.5. The software was used in stages of content analysis [1].

For the content analysis, the model for the development of inductive and deductive categories was applied according to [22]. The model of inductive categories consists in determining the categories from the text obtained in the research process, that is, from the answers to the questions. In this case, it was applied to the category of self-regulated learning and to the category lack of regulation. In this way, the concept category of self-regulated learning was specified from the data, giving rise to the following subcategories: regular emotions, general organization prior to the study, metacognition. Likewise, for the category lack of regulation, the following subcategories were specified from the data: disorganization and distractors, uncontrolled emotions, demotivation.

In the case of the phases of the self-regulated learning process, the subcategories were determined using the deductive model. For this, the Zimmerman model was used, from which the following subcategories are used: planning phase, execution phase, and self-reflection phase.

3. Results and discussion

The research was developed under an interpretative paradigm in the modality of descriptive investigation. The data analysis is elaborated in two phases; the first phase is qualitative for the definition of categories and subcategories of analysis. The second phase sample the result of the frequency count for each subcategory is shown in the graph of **Figure 1** at the end of the description of each of the categories and subcategories. Finally, **Figure 2** represents a proposal of a conceptual map showing the relationships between categories. It should be noted that the categorization of student responses allowed the possibility that a student, with the same

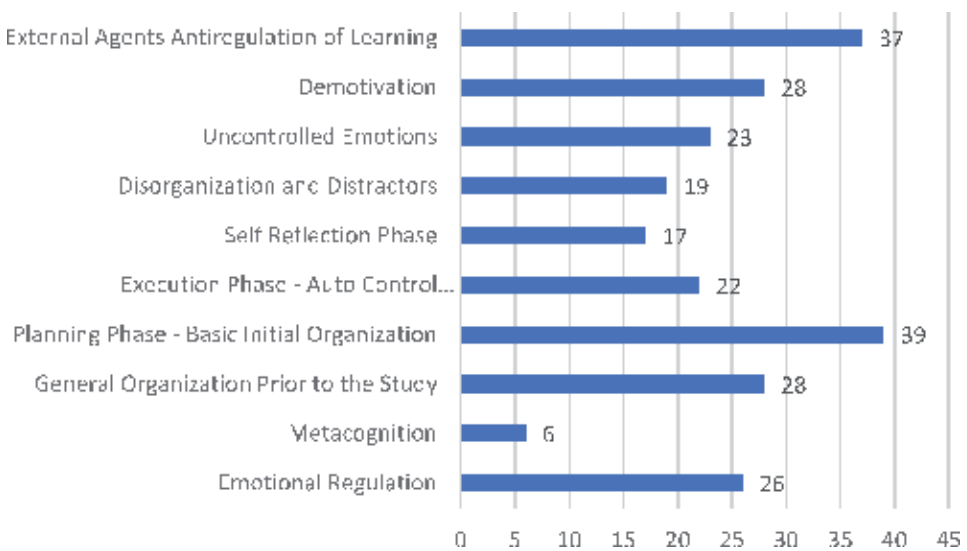

Figure 1.
Graph of total frequencies by subcategory.

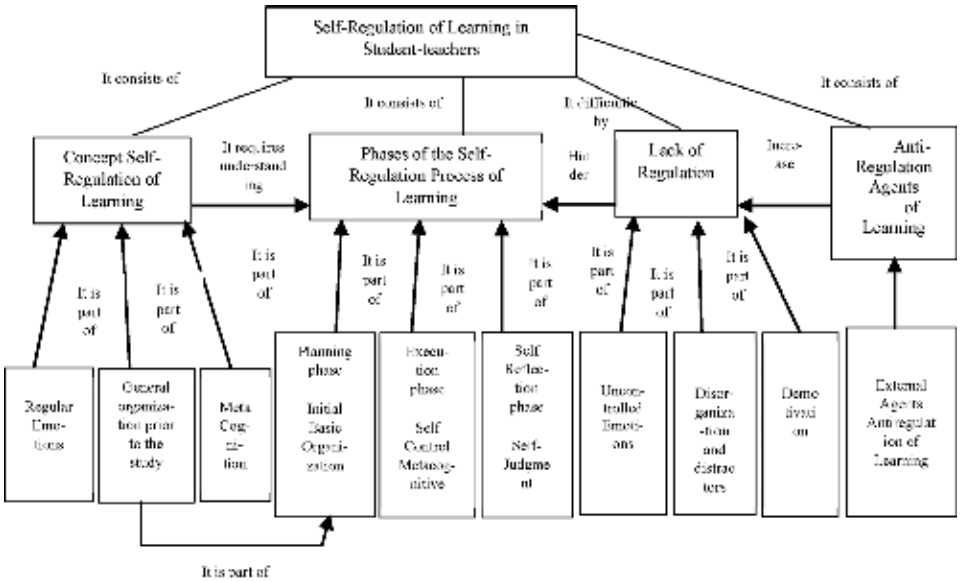

Figure 2.
Proposal of a conceptual model showing the relationships between study categories.

Dimension	Categories	Subcategories
	Concept of self-regulated learning	General organization prior to the study Emotional regulation Metacognition
Self-regulated learning	Phases of self-regulation process of learning	Planning phase—basic initial organization Execution phase—auto control metacognitive base Self-reflection phase
	Lack of regulation	Disorganization and distractors Uncontrolled emotions Demotivation
	Anti-regulation agents of learning	External agents antiregulation of learning

Table 1.
Dimension self-regulation of learning, categories and subcategories.

question, include information to be collected in two different subcategories. This is the case, for example, for the answers to the question, what do you understand by self-regulated learning?, because students pointed out as a response the general organization prior to the study what can be labeled as self-regulated learning concept and as part of the planning phase.

3.1 Self-regulated learning dimension

The dimension self-regulated learning allows to describe the perceptions of the participants in relation to four categories that are: concept of self-regulated learning, phases of the self-regulation process of learning, lack of regulation, and anti-regulation agents of learning. It should be noted that the lack of regulation and anti-regulation agents of learning is categories that emerged spontaneously in the discourse of the participants, even before consulting about the difficulties.

Table 1 shows the self-regulated Learning dimension, its categories and subcategories.

3.1.1 Category concept of self-regulated learning

The self-regulated learning concept category answer the following research question ¿what do (student-teachers) understand about the concept of self-regulated learning? In this context, this category refers to the perception of the student-teachers regarding the concept of self-regulated learning through the elaboration of a self-definition that explains the concept. In this sense, the concept of self-regulated learning has been associated with the following concepts that define three subcategories: emotional regulation, general organization prior to the Study and metacognition. **Tables 2–4** present some fragments of answers related to these three subcategories.

3.1.1.1 Subcategory emotional regulation

This subcategory indicates that student-teachers can define self-regulated learning through the regulation of emotions. Some fragments of answers are presented in **Table 2**. It is important to note that this definition obtained the second place of frequency in the concept category of self-regulation. In this sense, it is relevant that the students are aware of the importance of controlling emotions as pointed out by [4, 20, 21, 40] among others, since as future teachers they will have to intervene in classroom situations of deregulation of emotions of their students.

This result contributes to the literature on pre-service teachers' emotions by demonstrating their importance and the key role of controlling emotions to maintain self-motivation in a task during the execution of it and thus maintain interest and concentration [40, 42, 43].

3.1.1.2 Subcategory general organization prior to the study

The general organization subcategory prior to the study indicates that the student-teachers can define self-regulated learning through the conception of

Frequency	Emotional regulation
26	"... to regulate emotions, to regulate my emotions is for me to self-regulate my learning is as a condition for me to regulate my learning ..." "... self-regulating my learning is to regulate my uncontrolled emotions and thus self-regulate ..." "... and I must regulate my emotions to self-regulate my learning, the problem is that I do not know how ..."

Table 2.
Fragments of responses from participants related to the emotional regulation subcategory.

Frequency	General organization prior to the study
28	"... self-regulation of learning is how I organize myself. I make a list of the things that I have to do daily. If I have to study ... how much I dedicate to this or something else, that is my way of self-regulating learning ... "

Table 3.
Fragments of responses from participants related to the subcategory general organization prior to the study.

the general organization that they perform prior to the study. For this reason, it is noticed that it is not a specific, strategic planning for the development of an academic activity. Thus, they define a general way of ordering themselves.

This result is related to the control of the action, that is why the strategic planning in the planning phase is key because it is an action that allows to effectively control the progress of the objectives related to what is required to learn [4, 39].

This subcategory obtained the first place of frequency in the concept category of self-regulated learning, which suggests that the participants understand, for the most part, that this type of general organization could define the self-regulation of learning. However, it is suggested to work for an effective control of the action through strategic planning [4, 39].

In **Table 3** some representative fragments are shown.

3.1.1.3 Subcategory metacognition

This subcategory indicates the possibility of defining self-regulated learning using the concept of metacognition that refers to the process of self-reflection that subjects perform when judging their actions and reacting to their own self-judgment [37]. In this research only two student-teachers indicated as a possible definition of self-regulated learning to metacognition.

Metacognition is related to the control of thoughts that has been based on the strategic control of cognitive processes, this ability is important for student-teachers [11, 37]. Therefore, it is suggested that it is very important to incorporate in the training of thematic teachers related to metacognition.

Table 4 presents fragments of responses from participants related to this subcategory.

3.1.2 Category phases of the self-regulation process of learning

The category phases of the self-regulation process of learning answer the following research question ¿what do (student-teachers) they describe about the different phases of the process of self-regulated learning from the perspective of the Zimmerman model? Therefore, it presents itself the perception of the student-teachers regarding the process of self-regulated learning. To carry out the analysis, reference will be made to the cyclic model of self-regulation phases of learning by [37]. These authors conceive self-regulated learning as a cyclic process of three phases: planning phase, execution phase and self-reflection phase. **Tables 5–7** present some fragments of responses related to each phase of the self-regulation process.

3.1.2.1 Subcategory planning phase

The processes of the planning phase are task analysis and self-motivating beliefs. In relation to the first process it is shown that the students declare to make a planning oriented to the goal of obtaining a grade to pass a course. This coincides with

Frequency	Metacognition
6	"... Self-regulation of learning is for me the self-evaluation and reflection that I do of my academic results once I have the grades and at the end of the semester to think about what is wrong and to be aware of that, in order to improve ..."

Table 4.
Fragments of responses from participants related to the subcategory metacognition.

Frequency	Planning phase
39	"... I agree I plan and establish my goal associated with the note because I have to approve my courses..." "... the planning I do is designed to achieve the grade I need to pass and obtain the benefits of scholarships that I have, and I need them ..."

Table 5.
Fragments of responses from participants related to the subcategory planning phase.

Frequency	Execution phase—auto control metacognitive base
22	"... But with the courses in which I do well is pure memorization and what I have to apply is just that. For the same theme of the strategy that I execute that is to repeat and memorize, but I never knew if I learned with those courses ... " "... For me what works are the summaries as I had said before ..." "... My friends lend me their summaries ... or we do them together in the central library ... but like the rest I must admit that I do not know my study technique" "... The one that could indicate that I occupy is the summary when I study ..." "... We always worry about the final result, about the qualification and so the summaries help a lot, it's the synthesis of what I have to memorize ..."

Table 6.
Fragments of responses from participants related to the subcategory execution phase.

Frequency	Self reflection phase
17	"... The way I measure whether I'm learning or not, is like putting myself to the test if after a while I remember what I was learning, it's funny because it happens in many courses where I'm relatively better student, but it's not the one that I have learned the most, is only the one that I memorized the most for the test ... " "... Analyze the results, the factors. If you do not study or study late there is nothing to analyze. Take advantage of the hours given by the teacher to review the answers and ask directly what went wrong and thus correct the mistakes ... " "... See what is wrong, review the evaluation, rewrite down what is wrong and revise everything, to understand it again and things like that, study more for the next evaluation ..."

Table 7.
Fragments of responses from participants related to the subcategory self reflection phase.

what was proposed by Panadero and Alonso-Tapia [24] who point out that at this stage the student "analyzes the task, values their ability to carry it out successfully, establishes their goals and plans" (p. 451). However, it is noted that students do not plan strategically thinking about their learning, but they do it in a general way and thinking about obtaining a grade that allows them to pass their subjects, this result is similar to [33].

The foregoing is shown in **Table 5**, which presents representative fragments of participants' responses in relation to the planning phase.

It should be noted that planning is a predictor of the success that will be achieved in the task, so the longer the planning time the better results will be obtained [31]. Indeed, several studies point out that the biggest difference between expert and novice apprentices is due to the time they devote to planning [12, 34]. In the case of students participating in this research, there is no awareness that good strategic planning, both short-term and long-term, that is geared to learning, can benefit them in the context of twenty-first century skills specifically in the ability of learning to learn [36]. In short, it is noted that there is no strategic planning, but a basic organization prior to the study.

From the perspective of self-motivating beliefs, students are not aware of the importance of the variables that generate and sustain their motivation to carry out an activity, such as self-efficacy and expectations, among others. This is because the statement or description of self-motivation for learning is absent in their answers. However, their motivation is extrinsic and oriented to the goal that is manifested by declaring that they develop their academic activities to obtain a grade that allows them to pass their subjects. It is important to indicate that there is empirical evidence that students with learning goals choose and use strategies that direct them to deep learning, have reflection processes, recover before academic failures and their motivation is intrinsic [15, 17]. It is therefore important that students work in a lesser degree for a grade and focus mostly on their learning process.

3.1.2.2 Subcategory execution phase

Two processes are distinguished in the execution phase: self-observation and self-control, as pointed out by [37]. In this sense, students declare to use metacognitive self-control processes when they indicate that they use specific strategies such as underlining a text or making a summary when studying. However, they do not declare to carry out effectively the process of motivational self-control. For this reason, responses that have to do with obstacles to self-regulated learning that are related to disorganization, distractors, lack of control of emotions and demotivation appear recurrently. Nor do they declare that they carry out the self-observation process that implies a comparison between what is being developed and the ideal execution model.

In this sense, it is frequent that the student does not perform the process of self-observation during the execution of an activity which could be due to the following reasons: (i) in many cases the student does not have or does not know how to choose a model to follow to compare its development, (ii) the student is not aware of the importance of reviewing their learning process, (iii) the evaluation made by the teacher is the final product, in this way, the process is left behind or forgotten. In sum, the students participating in the study do not perform a monitoring process during the execution of their study. **Table 6** shows representative fragments of participants' responses related to the execution phase associated with metacognitive self-control processes, in which the summary appears as the study technique because it allows them to memorize what is most important for a test.

3.1.2.3 Subcategory self reflection phase

According to the model of Zimmerman and Moylan [37], the self-reflection phase consists of the process of self-judgment and self-reaction. In this sense, the results related to this phase show that the students reflect on their learning process by making self-judgments at the end of the process when they already have the grade and can review the test. Self-judgments are the processes by which the student judges their execution and which influence their self-reaction [24]. **Table 7** shows fragments of representative responses related to the self-reflection phase.

3.1.3 Category lack of regulation

The category lack of regulation answer the following research question, ¿what are (student-teachers) the difficulties in regulating their learning? In this sense, this category refers to the perception of the student-teachers regarding the difficulties they have to regulate their learning that has been called the lack of regulation has been associated with the following subcategories: disorganization and distractors, uncontrolled emotions and demotivation. This category was created due to the

recurring description by students of this type of difficulty to regulate their learning. The foregoing is in accordance with what was stated in the execution phase category, where a lack of the motivational self-control process was evidenced.

The lack of regulation could be due to a lack of volition activation, especially in the case of disorganization and distractors and demotivation. In this sense, volition is the strategic control necessary to carry out the process of executing a task and can be learned to control strategically [41, 42].

An alternative to help reduces the lack of regulation is co-regulation because it encourages self-regulation of learning. In this sense, Hadwin et al. [16] have suggested that a strategy to develop self-regulated learning of students is through interaction that plays a central role. The interaction allows the co-regulation of learning that refers to the "temporal coordination of self-regulation among others" [16] (p. 68) and therefore implies planning, monitoring and evaluation of learning in collaboration with others [16, 44].

3.1.3.1 Subcategory disorganization and distractors

The results associated with this subcategory are related to the difficulties that student-teachers have in relation to their own organization and that have a negative influence on the regulation of their learning. **Table 8** shows representative fragments of participants' responses related to disorganization and distractions; the results coincide with those presented in [33].

3.1.3.2 Subcategory uncontrolled emotions

In this subcategory the answers referred to the difficulty to control emotions are associated. The control of emotions is fundamental for the regulation of learning because in cases where they are not controlled there will be interference with learning, as pointed out by [4]. **Table 9** shows representative fragments of the responses of the participants related to the lack of control of emotions.

3.1.3.3 Subcategory demotivation

This subcategory represents the results associated with the demotivation problems described by the study participants. Motivation plays an important role in the self-regulated learning because it represents the motor that mobilizes the student to take actions and make decisions that allow him/her to achieve his/her goals or objectives. In this sense, the control of motivation has been studied by [20, 21] who emphasizes the role of emotions and how these can hinder the start of tasks or activities that the student must perform. **Table 10** shows representative fragments of the responses related to demotivation and that coincide with what was stated by [21].

3.1.4 Category anti-regulation agents of learning

The category anti-regulation agents of learning answer the following research question, ¿what are (student-teachers) the difficulties in regulating their learning? This category refers to the perception of the student-teachers regarding antiregulation agents of learning that are unforeseen and/or factors outside of them as students and that affect them in some way in their regulation of learning. Students describe being aware of these external factors and that they cannot control. This category has a single subcategory that is external agents antiregulation of learning. **Table 11** shows representative fragments of the responses related to external agents antiregulation of learning.

Frequency	Disorganization and distractors
19	"... When I study at home ... I lose a lot of time, I want to do anything, so I'm studying the last day ... I'm a mess ..." "... I want to comment on what happens for the evaluations ... we dedicate the previous night, "centralazo" with coffee all night, as much quantity and quality is not usually so bad when the pressure is so much. But the quality of life is the one that goes down ..." Observation: "centralazo" refers to the central library

Table 8.
Fragments of responses from participants related to the subcategory disorganization and distractors.

Frequency	Uncontrolled emotions
23	"... Many times, I love the course, I understand everything, but the evaluations arrive and I'm doing very badly. I think I do not control the anxiety. I forget everything. But then I realize that I know everything, and I do not understand why it did not go so well and maybe it's because sometimes more things affect the results in the evaluations such as concentration and emotions ... "

Table 9.
Fragments of responses from participants related to the subcategory uncontrolled emotions.

Frequency	Demotivation
28	"... I am discouraged because many courses are demotivating. They have no sense of utility, which is what gives meaning to a subject, when it is established so that it serves you something and why it is in your formation..." "... When you do not know what is useful for you, you may lose interest in the class and that will distract you ... " "... Listening to the professor without doing anything else is demotivating ..."

Table 10.
Fragments of responses from participants related to the subcategory demotivation.

Frequency	External agents antiregulation of learning
37	"... I want to add something that are unexpected events, for example, I regulate myself, I want to stop being stressed, but an external situation arrives that alters all that rhythm ..." "... It's an external factor that I cannot control, for example: room changes at the last minute, teachers who do not upload the material on time and that... force me to permanently change my planning ..."

Table 11.
Fragments of responses from participants related to the subcategory external agents antiregulation of learning.

Table 12 shows the summary of subcategories and frequencies where it is observed that the frequencies are low in relation to the total of participants that are 60 subjects. Then, **Figure 1** presents a graph of total frequencies for each subcategory in order to summarize the qualitative analysis described above. Thus, in **Figure 2** the subcategory metacognition has the lowest frequency and that the subcategory general organization prior to the study has the highest frequency. Both subcategories belong to the category self-regulated learning concept and the results obtained indicate that the student-teachers understand, in the first instance mostly, that the general organization they perform represents the concept of self-regulated learning. However, it should be noted that the three subcategories of the self-regulated learning concept are part of the self-regulated learning, but the students did not indicate the three together as a concept, but they did it separately.

Subcategories	Frequency
Subcategories of concept self-regulation of learning	
Emotional regulation	26
Metacognition	6
General organization prior to the study	28
Subcategories of self-regulation process of learning	
Planning phase—basic initial organization	39
Execution phase—auto control metacognitive base	22
Self reflection phase	17
Subcategories of lack of regulation	
Disorganization and distractors	19
Uncontrolled emotions	23
Demotivation	28
Subcategories of anti-regulation agents of learning	
External agents antiregulation of learning	37

Table 12.
Summary of subcategories and frequencies.

Regarding the phases of self-regulated learning process, in **Figure 2** it is observed that both the planning phase and the execution phase have the highest frequencies. This happens because the student-teachers indicated in their majority to execute a general planning and to use techniques like underlining and summaries during the execution of an academic activity. However, in both phases the development that they declare is incipient in relation to: (1) lack of strategic planning in the planning phase, (2) lack of processes of motivational self-control which influences the appearance in their discourse of difficulties to regulate their learning such as: disorganization and distractors, uncontrolled emotions and demotivation, (3) absence of self-records that allow them to compare and monitor the execution of their learning.

In sum, the major lack of learning are the lack of control of emotions and disorganization, followed by demotivation, which coincides with the approach of Kuhl [20, 21]. Kuhl points out that students who do not regulate their emotions can be oriented to the state and not to the action. In this way, they remain in states of worry or other emotional states that do not allow them to initiate, advance or execute their academic activities. It is important to note that defining the concept of self-regulated learning is complex because of the multidimensional nature of its construct, and although there are several models that help to understand the concept of self-regulated learning, none of them fully explains it [24]. Therefore, this research has used two models, Zimmerman and Kuhl to support the understanding of the phenomenon under study.

Figure 2 presents a proposal of a conceptual model that shows the relationships between the categories generated in the study. It is observed that the category anti-regulation of learning agents is related to the category phases of the process of self-regulation of learning through the relationship of hindrance. In addition, the self-regulated learning concept category is related to the category phases of the process of self-regulated learning by means of compression, this means that it is not possible to apply the phases of the self-regulated process adequately, but rather, there is awareness and understanding of the concept self-regulated learning.

Therefore, it is necessary to teach students how to learn through the knowledge of the models that explain how self-regulated learning should be done in such a way that they are aware of what it means to learn, what faults they have and how they could improve. In this way, this skill is encouraged since they will require it for the rest of their lives in the current context of society [30].

It should be noted that in **Figure 2** the category self-regulated learning concept shows three subcategories that are: (1) regulate emotions, (2) general organization prior to the study and (3) meta-cognition. However, despite the fact that the relationship that links them to the concept is called "it is part of" no student indicated a description using the three components to refer to the concept of self-regulated learning. Then, the relationship between the concept of self-regulated learning and the phases of the self-regulated learning process is "it is required to understand" what it implies, as mentioned above, that in order to go deep into the detail of each of the phases of the self-regulation process, first It is necessary to have a clear notion of what the concept means.

In the case of the phases of the self-regulated process of learning, in **Figure 2**, it is observed that it is composed of: (1) planning phase with basic initial organization, (2) execution phase with metacognitive base self-control and (3) self-reflection phase with self-judgment. In this sense, it is important to note that there is a difference with the Zimmerman model because students do not declare or describe processes such as the motivational self-control of the execution phase and the metacognitive self-control, they name is elementary. For that reason, it was denominated "base metacognitive self-control".

Then, the anti-regulation agents of learning category is related to the lack of regulation through the relationship "increase" because are external agents antiregulation of learning that can increase lack of regulation and in consequence obstruct the learning process of the student at any stage of the process.

In short, it should be noted that it is necessary for students to understand the concept of self-regulated of learning so that they can, through the approaches proposed by the models, be aware of the processes and strategies they can carry out to improve their own learning. In this way, in addition to improving the effectiveness of the study, the efficient use of time could also be improved, provided that the metacognitive process of self-regulation is significant for students, avoiding the practices and study strategies that lead to considering the learning as the result of the reproductive action of the knowledge and content of the subjects, fostering, through awareness, a reflective process about what is learned and how it is learned.

Regarding the conceptual model presented in **Figure 2**, its contribution is that it represents three components of self-regulated learning that are at the same level and that are related to each other. The first component is the concept of self-regulated learning that is related to the phases of self-regulated learning through the understanding of the concept. Then, lack of regulation influence the phases of the process of self-regulated learning, hindering one or more of the phases of the process of self-regulated learning. In this way, the model includes the understanding of the concept, development of the process, lack of regulation and external agents that hinder the development of the process. Other models studied are focused on the cognitive-motivational process [2, 11, 16, 25, 31, 35] and do not include components such as the understanding of the self-regulated learning concept, lack of regulation and external agents that hinder the development of the process.

In this sense, we agree with Hernández and Camargo [19] who point out: "the task of characterizing the Ibero-American university students is essential in order to identify their dimensions as self-regulating subjects of their learning process. This information is of central importance when designing and implementing plans, programs and actions in the training scenarios that contribute to the advancement

of students in their academic studies, as well as the promotion of guidelines for the generation of student autonomy understood as self-regulated learning" (p. 156).

Additionally, we agree with Saariaho et al. [40] that: "clear and personally valuable goals for learning, a sense of control over one's own learning activities, as well as an ability to reflect individually and with others are the key elements in active, intentional, and engaging teacher learning." (p. 552). Therefore, including activities that encourage co-regulation is key in teacher training because they enhance learning and positive emotions [40].

Finally, it should be mentioned that the study has limitations such as the size of the sample that considered 60 subjects and the fact that the study was conducted only under the qualitative paradigm. However, these limitations can be remedied in future investigations that are carried out using self-report instruments with samples of more than 300 students and qualitative studies with samples of students from other areas. This is because the same guideline of questions in this study can be used, which has had the purpose of being applied as a pilot to direct the following investigations that will allow the diagnostic processes in freshmen students. Also, it is interesting to mention that there are researches in university students in the engineering area that have shown equivalent results [33] in relation to the lack of planning and monitoring of their learning process but they do not describe lack of regulation and external agents that hinder the development of the process.

4. Conclusions and recommendations

The conclusions of this chapter are:

1. It is proposed conceptual model includes components that represent: (i) the understanding of the concept of self-regulation of learning, (ii) development of the process of self-regulation of learning, (iii) difficulties to regulate their learning named lack of regulation and (iv) external agents antiregulation of learning.

2. The proposed conceptual model can be further improved so that it serves as a basic guide in the training of independent professors of the level. That is, in the training of secondary school teachers or higher education teachers.

3. The improvements of the conceptual model can be oriented to collect more data through group and/or individual interviews to raise more categories and empirical subcategories. Then, methodological and/or strategic recommendations for the promotion of self-regulation could be suggested.

4. For the research question, what do (student-teachers) understand about the concept of self-regulated learning?

    i. In relation to the understanding that participating students have about the concept of self-regulated learning, it is noted that they refer mainly to the general organization prior to the study and the regulation of emotions. In this sense, it should be noted that the organization they carry out is not aimed at the purpose of their learning but is aimed at obtaining a grade.

    ii. The understanding of the concept of self-regulation of learning by teachers allows us to analyze what their weaknesses are with respect to

understanding to work on a process of continuous improvement of your abilities.

5. For the research question, what do (student-teachers) describe about the different phases of the process of self-regulated learning from the perspective of the Zimmerman model?

    i. It is concluded that the students do not carry out a strategic planning and that, when executing an academic activity, they mostly use the summaries. However, it is suggested that they have not developed each of the phases exhaustively, since, for example, the planning phase is not strategic. Additionally, in the execution phase it is not common for them to carry out self-registrations that allow them to compare the previous actions with the new execution.

    ii. In summary, the planning and execution phase are incipient in relation to: (i) lack of strategic planning in the planning phase, (ii) lack of motivational self-control processes, which influences the appearance in their discourse of descriptions of lack of regulation such as: disorganization and lack of control of emotions, (iii) absence of self-records that allow them to compare and monitor the execution of their learning. Therefore, the participating students do not describe a monitoring process during the execution of their study.

6. For the research question, ¿what are (student-teachers) the difficulties in regulating their learning?

    i. Two are proposed, which are:

        a. lack of regulation

        b. external agents antiregulation of learning

    ii. The lack of regulation is the difficulties to regulate their learning. In this sence, it was obtained that uncontrolled emotions, disorganization, constitute impediments that hinder learning. However, it should be noted that students are aware and reflect on these obstacles.

    iii. In relation to the understanding have about the other difficulties to regulate their learning, the student-teachers when studying pedagogy understand and have "conscience" of the characteristics of the educational system. In this way, they perceive and describe the subcategory external agents antiregulation of learning.

7. Finally, it is important to conclude that for student-teachers it is essential to understand the concept of self-regulation of learning and the stages of the process of self-regulation of learning so that:

    i. Apply self-regulation of learning to be self-regulated student-teachers.

    ii. When they perform their work as teachers in the classroom, they promote self-regulation of learning in their students through:

        a. Teaching strategies that promote metacognition.

b. Using strategies that allow them to learn to strategically plan their study to become aware of their learning process.

c. Using instruments that allow self-registration to compare and monitor the execution of their learning, among others.

d. Applying strategies that encourage the co-regulation of learning.

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Author details

Carolina Zambrano-Matamala[1*], Darío Rojas-Diaz[1], Pedro Salcedo-Lagos[1], Felipe Albarran-Torres[2] and Alejandro Diaz-Mujica[3]

1 Department of Research Methodology and Educational Informatics, Faculty of Education, University of Concepción, Concepción, Chile

2 Department of Basic Sciences, Faculty of Medicine, Catholic University of the Most Holy Conception, Concepción, Chile

3 Department of Psychology, Faculty of Social Sciences, University of Concepción, Concepción, Chile

*Address all correspondence to: carolinazambrano@gmail.com

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Chapter 9

Teaching, Reflecting and Learning: Exploring Teacher Education Study Abroad Programs as Transformational Learning Opportunities

Allison Freed, Aerin Benavides and Lacey Huffling

Abstract

An essential goal of teacher education is to reveal cultural blindness, bias that may be hidden from preservice teachers' awareness. This may include unintentional biases, misunderstandings, and stereotypes, which can affect what happens in the classroom. Transformational learning through cultural immersion experiences can reveal what is hidden, allowing students to critically reflect and revise assumptions and perspectives leading to cultural competence and culturally relevant pedagogy. Teacher education study abroad experiences can transform preservice teachers' ethnocentric worldviews and lead them to adopt more culturally competent mindsets. Reflection is key to participants understanding the impacts from a study abroad experience, and several years may pass before participants realize how much impact their experiences abroad had upon them. We used case study methodology to examine the meanings four teachers make of the long-term effect of a study abroad experience on their cultural awareness and pedagogical decisions. This use of retrospective methods may help to understand that the impacts of teacher education study abroad are difficult to articulate and assess directly after the program, and thus encourage program designers and researchers to provide participants opportunities to venture out of their cultural comfort zones and reflect upon their experiences a year or more after the study abroad program.

Keywords: study abroad, teacher education, preservice teachers, transformational learning, cultural awareness, cultural competence, culturally relevant pedagogy

1. Introduction

In recent years, teacher education has included cultural awareness and competence as skills preservice teachers needed to develop in order to engage more culturally relevant pedagogy [1–2]. The optimum is to engage preservice teachers in cultural activities that reveal cultural assumptions and biases (cultural awareness) and celebrate students' varied lived experiences with the goal that these experiences will increase preservice teachers' understanding of different cultures and how

culture impacts communication and social interactions (cultural competence) thus increasing their use of culturally responsive pedagogy [2, 3]. As Cushner argued, "Teacher educators should provide significant intercultural encounters for preservice teachers who typically are not experienced in cross cultural matters." [4], p. 37.

One way to accomplish this goal is through cultural immersion experiences, which can reveal what is hidden, allowing students to critically reflect and eventually revise assumptions and perspectives to become more culturally aware, which leads to cultural competence and culturally relevant pedagogy [2–6]. Teacher education study abroad programs can provide cultural immersion, allowing preservice teachers to critically assess what is normally hidden within their own culture and/or the dominant culture of their home country. As Cushner noted, "Teacher education faculty represent a critical link in structuring educational experiences that assist their students to reach out to the international community, both at home and abroad, with the aim of forging relationships based on deep and meaningful understandings of peoples' similarities as well as differences." [4], p. 37.

However, cultural awareness does not occur instantly [7, 8]. Guided reflection after thoughtful, dissonance inducing experiences is key to aiding participants in understanding the personal impacts of study abroad experiences and how these experiences have increased their cultural awareness. Students must move mindfully through the process of cultural learning, in order to successfully change their worldview [10]. Given this, transformational learning theory is one framework educators could use to design study abroad programs to help develop preservice teachers' cultural competence through meaningful reflection activities, leading to changed worldview and behavior [4, 10]. Transformational learning can be defined as the "process of effecting change in a frame of reference" [10], p. 5 and facilitates autonomous thinking that can result in action-oriented behaviors [11]. In order to experience transformational learning, cognitive dissonance is necessary so that participants reflect on their experiences and decide to change perspectives either through behavior change or worldview change [1, 6, 7, 10].

Transformational learning theory also changes the nature of study abroad research. If participants must think long term and longitudinally about their experiences abroad, the time after studying abroad may not be sufficient for getting at the true cultural learning that happened during the experience abroad [12–14]. According to Wong's evaluation of study abroad assessment, "Dewey's [1938] perspective suggests that a fruitful place to look for the effect of study abroad experiences is in the experiences that students have after the program" [15], p. 124. Thus, to properly assess the impact of study abroad (i.e. in what context participants teach, participants' pedagogical practices, and cultural worldviews), researchers must consider a number of strategies, ones that span an extended period of time and include a variety of end goals. This longitudinal perspective allows more time for transformative learning and for participants to deeply reflect on the impacts their study abroad experience truly had on their lives [4, 10, 15, 16, 20].

Given this, we postulate that the impact of study abroad needs to be explored retrospectively as it is difficult to articulate and assess participants' transformational learning directly after the program [15]. To further explore this possibility, we developed four descriptive case studies of participants from two different study abroad programs. The research questions that guide our chapter are:

What meanings do teachers make retrospectively on the long-term impacts of teacher education study abroad programs in regard to transformational learning?

How do these meanings impact the teachers' cultural awareness, cultural competence, and pedagogical practices?

2. Theoretical framework

Our theoretical framework is transformational learning theory given we hypothesize teacher education study abroad experiences can have a transformational effect on participants' long-term cultural awareness, competence, and culturally responsive pedagogies [1]. For the purpose of our study, we define transformational learning as deep change that stems from experiences of disorientation that make one feel like he or she has a new perspective or understanding. We focus on the three-stage model of transformational learning [1, 17]: 1. Disequilibrium triggering experiences; 2. Critical to frame of reference; 3. Changes in viewpoint and future plans.

We define a disequilibrium or triggering experience as any experience that elicits a sense of disorientation or dissonance [4, 10]. A disorienting experience elicits a sense of a discrepancy between what one thinks is true and what is real. This idea stems from Piaget's theory of cognitive constructivism. Piaget postulated that learning occurs when individuals pass through a time of discomfort or disequilibrium to resolve the discrepancy between their existing schemas and the new information being processed [18]. We define critical viewpoint as a stage of reflection and growing awareness. During this stage, ones' frame of reference becomes apparent and subsequently assumptions are critically questioned through deep reflection and discussion [1, 10]. Transformational learning is defined as a deliberate change in actions that were elicited by deliberate reflection, questioning, and discussion about one's frame of reference [10]. Change that is elicited through transformational learning can include exploration of new roles, actions and relationships, planning for future action, revising existing ideas using the new information acquired, and realizing the need for more information and skills [1, 4]. Thus, inherent in transformational study abroad programs are experiences that lead to dissonance, guided reflection and discussion that lead to changed frames of reference and action-oriented behaviors.

We, as researchers and teacher educators, see study abroad experiences as a way to expand the horizons of preservice teachers in order to assist them in serving all students in their classrooms [19]. We postulate that transformative study abroad experiences have the capacity to increase the likelihood of preservice teachers to use culturally relevant teaching practices. These teaching practices are outlined by Ladson-Billings to include having high expectations for academic achievement for all students, being culturally competent and developing their students' cultural competence, and being critically conscious and developing the sociopolitical viewpoints of their students [3]. Teachers who are considered culturally responsive feel that one of their major responsibilities is to help their students become academically successful. A tenet of cultural competence is allowing students to maintain their cultural characteristics while completing academic tasks. In essence, finding value in multiple ways of knowing and experiencing the world. Study abroad experiences with embedded reflection can also encourage preservice teachers to recognize social inequities and be aware of their own biases. In turn, helping their students to recognize social injustices, motivating them to take action to change the status quo.

Given transformational learning takes time [9, 11], we conducted a longitudinal study with a focus on the transformation of preservice teachers that occurs years after a study abroad cultural experience. This aligns with the continuity of experience [17] based on the view that experiences have a lasting impact on each subsequent experience. All new experiences are somehow influenced by the transformational experiences that happened before. The study abroad experiences promoted an imbalance between what preservice teachers understood and what they encountered while abroad, which through reflection changed their frame of

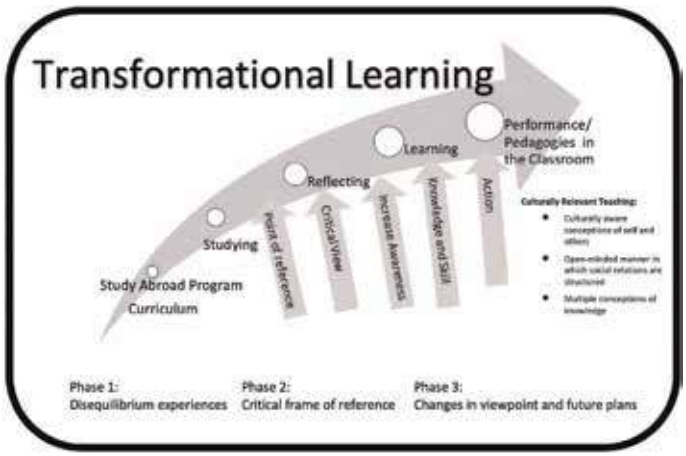

Figure 1.
Sequential transformational theoretical framework in three phases based upon study abroad design [1, 10, 17].

reference and led to transformative learning that led to a change in their teaching performance. In addition, Ladson Billings also outlined three propositions which can be used to improve and evaluate culturally relevant teaching. These propositions are 1. The conceptions of self and others; 2. The manner in which social relations are structured; 3. The conceptions of knowledge [3]. These propositions help us organize the transformation we found in our participants' frame of reference and how this translated into their classroom practice (see **Figure 1**).

3. Study design

Our study presents four case studies developed from two different study abroad programs: Maastricht and Manú (see **Table 1**). The Maastricht trip was developed over many years by two universities, and the Manú trip was a first-time endeavor for a third university. These programs were studied because of their similar structure both of which are short term faculty led teacher education programs. In addition, we chose these programs as a way to improve our practice as study abroad curriculum developers, teacher educators, and scholars of teaching and learning. The four focal case study teachers have 2–8 years of experiences since completing the study abroad programs, which enabled our participants to retrospectively reflect on their time abroad and how their worldview, career choices, pedagogical decisions, and their thoughts on bias and privilege were impacted [15, 16]. Our current study was exempted from IRB oversight; previous data were collected under IRB approved projects. Participant consent was obtained prior to data collection.

3.1 Settings

3.1.1 Maastricht

The Maastricht program was 3 weeks (20–22 days) long with a focus on the cultural aspects of education and the education system in an international context. Two universities participated in this trip from 2011 to 2015 and 2017, with a total of 79 students. Most students who participated in this program were education majors. Over the course of the years, the group size varied from 9 to 14 students. The course

Program	Program goals	Pre-departure preparation	Assignments abroad
Maastricht	Compare the American and European educational systems Move from cultural comfort zones Develop cultural competence Use technology for educational purposes Gain transferable skills and knowledge while learning about the option for teaching internationally	4–5 one to three-hour whole group meetings to discuss: • Dutch & German education system • American and European culture • Packing and general travel information • Former participants as guest speakers • Lesson planning • Creating and building Facebook page for program communication • Transferable goals discussion & selection video log	3-hour alone experiences with video-log reflection (*Disequilibrium triggering experiences*) 5 inquiry assignments composed of a question about culture or education to be answered through the inquiry process (*Critical to frame of reference*) One synthesis video/digital story as a culmination of the experience (*Transformative change, plans, actions*) Post assignments to program Facebook page (*Transformative change, plans, actions*)
Manu	Compare the American and Peruvian educational systems and ecosystems Develop appreciation for Peruvian culture Move from cultural comfort zones Develop cultural competency Gain transferable skills and knowledge while learning from international scientific endeavors	5 two-hour whole group meetings (2 hour) to discuss: • Briefing by Office of International Travel • Program overview and packing • Peruvian culture with guest speaker • Three Basic Spanish sessions • Student presentations of required readings • Intro to art craft • Designing lesson for all day English and ecology fair	Implementation of lessons developed for *all-day* Environmental Education "Feria" (fair) in English at a free access non-profit school near Lima for K-11 students (*Disequilibrium triggering experiences*) Participation in lectures, group tours, & group jungle hikes (*Disequilibrium triggering experiences*) 12 daily reflective journals on cultural, wildlife, and environmental experiences (*Critical to frame of reference*) 'Unpacking' in whole and small discussion groups (*Critical to frame of reference*) Short essay as a culmination of the experience collected into online book (*Transformative change, plans, actions*)

Table 1.
Study abroad programs.

was taken for elective education course credit. The program consisted of visits to the Netherlands, Belgium, France, and Germany. While abroad, students were accompanied by at least one European guide, a faculty member and a program assistant during all aspects of the trip, and they lived together and attended schools together.

Students visited and examined a number of schools that included International Schools, Dutch and German public and community schools, a Refugee School, and an after school learning/enrichment program. The schools differed in a number of ways. They differed in the demographics of students, the cost for admission, and in the teaching strategies administered. The International Schools were mostly fee-based schools serving some Dutch and German students, but mostly expatriates from other countries around the world. These schools were vastly different from the Refugee School This school was created by the Dutch government as a way to assimilate young refugee students (ages 10–17) into the Dutch society. This

included Dutch language, math, and some English classes. Students who attended this school were new arrivals into the country from nations such as Afghanistan, Iraq, Iran, Syria, Somalia, and Eritrea. Study abroad students had a chance to teach at least one lesson while at the Refugee School. They created a lesson about American culture and a lesson to teach a short performance (e.g. dance or skit) to a small group of refugee students to perform for the entire school at the end of the two-day visit. The study abroad students observed classroom meetings, talked with the students, taught students the culture lesson and other performance. The other school visits were much shorter and included classroom observations and discussions with teachers and principals.

In addition to school visits, students interacted with their peers, Dutch preservice teachers. These teachers in training were working on a degree for teaching English as a second language in the Netherlands. During the day-long interaction, Dutch and American students discussed topics of culture and education. These topics included the cost of an undergraduate education, the structure of after school activities, youth culture, and teacher training.

3.1.2 Manú

The Manú program was 12 days long with a focus on Environmental Education (EE) and educational exchange in cultural immersion with Peruvian scientists, wildlife guides, educators, and a school (K-11). A large public state university in the Southeast instituted this trip. Most participants in this program were elementary education (K-6) majors who had been in either a two-year science or social studies focused cohort. The trip was structured to be part of an existing student teaching seminar class for seniors; therefore, all education students had completed their final student teaching internships prior to commencing the trip. The program's cost was minimal to participants as it was sponsored by a non-profit organization. Despite this, only 11 out of 23 science cohort students and 4 out of 24 social studies cohort students went on the trip. This allowed for five additional undergraduate students from an honors course to participate: four Biology majors and one Music major. Nine faculty and staff also went on the trip (2 Science Education professors, 2 Science Education doctoral students, 2 Biology professors, 1 Biology graduate student, and the Assistant Dean of the School of Education) for a total of 29 people.

The trip to Peru included 4 full days in and around Lima. During this time, participants engaged in: attending a bio-ecology conference at a university in Lima with presentations by local scientists, teaching English ecology-focused lessons at a low-income area philanthropically endowed low-cost private school in Chorrillos, visiting pre-Colombian and Inca ruins, and spending the day at a farm in Pachacamac. For the next week, participants traveled by air, land, and water to explore the southeastern Peruvian rainforest, which included visits to biological study stations and an extended stay at a remote birdwatcher lodge near the Manú Rainforest preserve.

During the Lima and traveling portion of our trip, we sought to help blend the two preservice cohorts and the honors course students into one cohesive group through rooming arrangements and assigned travel groups. We only had two male students, who always roomed together, but we intentionally had all female undergraduate student participants room with different people every day as we traveled to and from the jungle.

The guides knew both the paths and the wildlife well and had us up at prearranged hours to leave as a whole group early each morning for our hike. There were few moments for 'down time', but we made sure to preserve the required reflective journal writing and group discussion time each evening and had one evening to watch a documentary about local tribal displacements. At the end of the

trip to the rainforest, when we returned to Lima, students had a day off to explore the city on their own.

3.2 Participants

The Maastricht program had a total of 79 student participants, who were eligible to be part of our study as they completed their study abroad experience prior to 2018. Ten participants volunteered and were interviewed. The Manú program had a total of 21 students, with 16 being eligible for this study as they were education majors. Four participants volunteered and were interviewed.

From the 14 interviews, we selected 4 participants to focus on as case studies. Selection consisted of certain requirements: marginalized racial and ethnic groups, a participant from each of the three universities, two participants from each study abroad program, a variety of grade levels taught, and inclusion of at least one male and one female (see **Table 2**).

3.3 Methodology

For this study, we used a descriptive case approach [21]. We selected this approach as we are interested in understanding our participants' perceptions of their time abroad through multiple sources of data [22]. Our bounded unit was two study abroad programs which focused on providing preservice teachers cultural experiences abroad and comparing/contrasting these with the students' culture. The descriptions of our participants' lived experiences and reflections during and after a teacher education study abroad programs helped to define the theoretical constructs under which study abroad programs can be used as transformative learning experiences for preservice teachers.

3.4 Data collection

Data sources for the Maastricht program included participant video logs, researcher field notes, researcher prior knowledge of participants as students when applicable, and semi-structured post interviews. Data sources for the Manú program included reflective essays written immediately after travel, researcher field notes, prior knowledge of researcher of participants as students, and semi-structured post interviews. All post interviews were video and/or audio recorded using the same semi-structured interview protocol (Appendix A). Two co-researchers, one from each

Participant	Program	Ethnicity	Gender	Age	Current school/grade	Years taught	Years since program
Devon	Maastricht	Mixed race American	Male	27	Urban high school in Southeast U.S./9th grade	3	8
Andrea	Maastricht	Hispanic American	Female	22	International school in Honduras/Kindergarten	1	2
Tanyia	Manu	African American	Female	26	Urban elementary school in Southeast U.S./4th grade	5	5
Lucia	Manu	Hispanic American	Male	28	Urban middle school in Southeast U.S./6th grade	5	5

Table 2.
Case study descriptions.

program (Maastricht and Manú) conducted the post interviews of participants from their respective program.

In the interviews, we asked questions to help us capture our participants' cultural awareness and developed cultural competencies as evidenced in their descriptions of their pedagogies. Interview questions were structured in such a way as to elicit participants' perceptions and reflections on their lived experiences while abroad, how those experiences may have affected their intercultural sensitivity development [16], how their lived experiences afforded cultural awareness and added knowledge and skills, and how this has influenced the current pedagogies they employ.

3.5 Data analysis

Data analysis was theory-guided [23]. Ten a priori codes were determined that aligned with our theoretical framework of transformational learning theory ([4, 10], see **Table 3**). Dedoose software was used to analyze our data sources for each round of our coding process. Two of us performed the majority of the data analysis so that the third author could provide member checking in how coding was implemented.

In our first round of coding, we independently coded each focal case study using the 10 a priori codes. Then, we met together to compare our first round of coding to come to agreement on how we were defining the 10 parent codes. Next, we individually analyzed each of the 10 parent codes for emerging patterns and themes and then met together to decide on the final blended coding, which lead to five subcodes (see **Table 3**). We then compared our coding across our participants. Through this process, we fine-tuned our common definitions of terms and codes, as well as the range and limits of each code for this study.

Once the essays, video transcriptions, and interview transcripts were coded, data were analyzed with Dedoose software features that allowed us to spotlight high frequency codes on an x-y axis graph for two codes and sized 'bubbles' for a third code. Using graphic visualizations of the code frequencies in data codes helped us as researchers to systematically compare and contrast codes for the four focal case studies. Once we felt we had captured all the salient codes, we compiled our four descriptive case studies' 10 parent codes and the five subcodes into three emerging themes. These three emerging themes were: History/Context; Study/Reflect/Learn; and Perform/Pedagogy. These three themes became the case study framework for reporting our findings with regard to transformational learning and culturally relevant pedagogy (see **Table 3**).

3.6 Validity

Triangulation of the data collection was achieved through multiple sources of data and through agreement upon emerging themes that served as the basis for organizing our focal case studies. The emerging themes were connected back to our theoretical framework for alignment with our participants' lived experiences and perceptions. Our third author provided peer debriefing or analytic triangulation as she was not engaged in the data collection or analysis process, so she was able to help us reflect on our thinking through these processes and to look for researcher bias or assumptions.

4. Case studies

In this section we present our four case studies, using pseudonyms for people and places to maintain confidentiality. Each case study narrative provides a brief

A priori parent codes	Case study themes	Discussion themes
1. Increased cultural awareness	Perform/pedagogy	Phase 2: Critical frame to reference Phase 3: Changes in viewpoint and future plans Cultural awareness, competence, and relevant pedagogical practices
2. Knowledge and skills i. Cultural ii. Pedagogical iii. Higher tier	Study/reflect/learn	Phase 3: Changes in viewpoint and future plans
3. Identity transition and skills	History/context	Phase 3: Changes in viewpoint and future plans
4. Seeking out cultural experiences	Perform/pedagogy	Phase 2: Critical frame to reference Phase 3: Changes in viewpoint and future plans Cultural awareness, competence, and relevant pedagogical practices
5. Taking cultural action	Perform/pedagogy	Phase 3: Changes in viewpoint and future plans Cultural awareness, competence, and relevant pedagogical practices
6. Challenging own culture	Study/reflect/learn	Phase 2: Critical frame to reference Phase 3: Changes in viewpoint and future plans Cultural awareness, competence, and relevant pedagogical practices
7. Connection to place	History/context	Phase 1: Disequilibrium triggering experience Phase 2: Critical frame to reference Phase 3: Changes in viewpoint and future plans
8. Culture of origin iv. Subculture USA	History/context	Phase 2: Critical frame to reference Phase 3: Changes in viewpoint and future plans
9. Recognized by others v. Culturally	History/context	Phase 3: Changes in viewpoint and future plans Cultural awareness, competence, and relevant pedagogical practices
10. Reflection	Study/reflect/learn	Phase 2: Critical frame to reference

Table 3.
Coding map.

overview of the participant's personal 'history and context', what they learned, noting evidence of transformational learning and subsequent development of pedagogical knowledge and skills.

4.1 Devon

> *"The biggest thing in my point of view that this study abroad has done for me is opened my eyes to other ways of life and education besides the American way. After this study abroad, I can honestly say I have improved as a person and a teacher. I've grown simply because of the fact that I have learned new things from every teacher I have talked to over here." Vlog Synthesis while abroad [2011].*

4.1.1 History and context

Devon was a 27-year-old, male teacher. He self-identified as mixed race. He taught for 3 years. Devon always knew he wanted to be a teacher in an urban setting. His passion for urban education grew from his own experience at a Title I midwestern urban school. This passion led him to study in the urban education cohort at a large Midwestern public university. The cohort provided Devon the

chance to take education courses that emphasized urban learning environments and the impact of context on teaching and learning. Eventually, Devon completed his year-long student teaching experience in a classroom in a large urban midwestern city. In 2011, at 19 years old, Devon participated in the Maastricht study abroad program. Before the study abroad program he had only traveled to Mexico with his family. He is now a teacher in an urban school district in a large southeastern city. He taught ninth grade at this school for 3 years. Currently, Devon is pursuing his Master's degree in Curriculum and Teaching with an emphasis on cultural and socioeconomic components of teaching and learning.

Devon is passionate about cultural issues including race and privilege, and how these intersect with education. It was apparent that Devon's educational background influenced his career choice. As his instructor, I was impressed with his ability to challenge his own cultural understanding of the world, which included his growing awareness of his privilege. He reported that the experience abroad assisted in his evolving understanding of implicit bias and how privilege plays out in the world.

4.1.2 Study, reflect, learn

> *"...it (study abroad) just really did a great job at breaking down my ideas, kind of breaking down the blinders I had (in) relation to privilege and what good education is, and what we can do as teachers and the things that we are equipped with, and know how to overcome things like that." Post Interview [2018].*

The study abroad experience had a significant impact on his views and assumptions on privilege. "...how race, socioeconomic status, gender, sex, religion, plays a role in education and as we develop as teachers, it's got so many different layers and just things to learn about what you learn in actual classes. So, it was just life changing on so many different levels." To him, this was especially significant as an American undergraduate student studying abroad in Europe. As a teacher in an urban school he reflected back on the experience abroad as a truly impactful experience for examining privilege in the classroom.

Devon viewed education as an essential component of a well-rounded life but also recognized education as a system with global implications. He gave credit to the study abroad experience, the urban education cohort courses, and his experience teaching in an urban setting to his pursuit for equity in his classroom. He was globally aware and understood that his knowledge and experiences were possible based on his identities and how those identities intersected with his position in the world.

The Refugee School exposed him to people and their personal stories of survival that he had never heard before. Devon's privilege once again came to light after an intense, and somewhat disorienting conversation [6, 10, 24] with a refugee student and a Dutch interpreter.

"There's one story where we had gone to what I believe was, like, a Refugee School in the Netherlands, and I had asked a question to one of the students. It was like a high school age student, and he was from Iran or maybe Afghanistan. I'd asked him what he wanted to do with his life, (how) he had gotten over (to) the Refugee School and his translator had looked at me and apologized cause he's like, "he hasn't given it any thought because he never expected to live to this age," so he had not considered what to do with a job. He came to the conclusion that he was going to be killed in the fighting in his country, so that was a really eye-opening experience for me, and as a privilege that I have and the privilege I think us, as Americans, have."

In addition, Devon transferred his critical reflection to the news media in the US. Devon changed his frame of reference and thus viewed the messages received from the American news media differently. He became highly critical of the messages being shared about refugees and people who are from other places. With this new first-hand knowledge, he began to be critical of his "blinders" (biases) as well. Devon remembered that after hearing about the horrific experiences that young refugees experience throughout their lives, including their journeys to their asylum country, he began to examine his assumptions about others from places outside of the United States and tied these to his teaching practice.

Devon became keenly aware of injustices in the world. After the visit to the Refugee School, the group visited an International School in the same city. Devon continued his critical reflection, nothing the stark differences between the two schools.

"Then I think the other story that really stood out to me was in the same town we visited, that very-very high-end type school that had, maybe it was middle school, that had children speaking multiple languages, one to one technology, and all sorts of bells and whistles that I think it just kind of reaffirmed that the socio-economic gap is not something that happens in America, for education. Obviously, as educators and going to colleges, in America, we're often taught to and talked about those socioeconomic gaps that actually happen in our schools. But we need to be mindful they exist all over the globe and it's not just United States' issues. We have to work as educators globally to figure out how to solve that and how to make sure all students receive that equity in the classroom no matter how much money their school does or does not have."

4.1.3 Perform/pedagogy

> *"I think I was making progress towards being a more globally responsible citizen, and educator." Post Interview [2018].*

Devon had a strong sense of obligation and service to the education field. Since Devon had the privilege of studying abroad, he felt that he must take action and share his experiences with other educators. According to Devon, the experience led him to feel more responsible for the continued evolution or growth of education. To him, going to another country to study education was a true privilege that should not be wasted.

Since traveling abroad, Devon saw his students as people with values, beliefs, and perspectives that may differ from his own [4], and he understands the importance of appreciating, recognizing, and empathizing with his students [4, 5]. "It eases their (students') mind a little bit to know that they have a teacher who tries to be kind of, as culturally responsible as I can. And who is, tries to make them as comfortable as I can, with accepting and celebrating the cultures in different places and different ideas that their families come from and have. "His students come from a variety of countries and regions (e.g., Mexico, Peru, Central America, Africa, Middle East, Asia), speak a number of languages, and view the world in ways that differ from Devon's perspective. Despite the level of discomfort, Devon finds ways to connect with his students, essentially maintaining a fluid teacher-student relationship and connecting with students at a level outside of the classroom [3]. He consistently works to explore his students' cultures. He talks with parents, attends community events, and reads to gain knowledge about his students' diverse backgrounds. For instance, he mentioned even though he cannot speak Spanish and does not know much about the Catholic religion, Devon recently attended his student's Catholic confirmation. "So, it was definitely an interesting event, but the

fact to be there for her because it meant a lot to her and it's something that I'm not comfortable with or not familiar with or likely, and it just is something that is near to me and you know, just is always fun of learn new things even if they are uncomfortable at first." Devon continued to develop his global competencies and his cultural competence, by seeking out culturally uncomfortable situations. "I've got to start thinking outside of the box and expanding (my) horizons that way."

4.2 Andrea

> *"I feel like I was confident abroad, which is something I've never really considered myself that back in the states. That was something I noticed this past summer when I was traveling. My friend said, "You just carry yourself in a different way... And it looks like you lived here. You know what you're doing." Post Interview [2018].*

4.2.1 History and context

Andrea did not attend university with the goal of becoming an elementary teacher but made the decision after a year on campus. Andrea participated in an education study abroad program to Maastricht as a junior in the spring of 2017. Before the study abroad experience, she had traveled to Mexico to visit her father's childhood home. She completed her undergraduate studies at a small southern private university. At the time of the interview, she was a 22-year-old Latina, and a first-year kindergarten teacher at an American International preK-12 school in Honduras. Most of her students were English Language Learners from Honduras. The interview took place only a month after she started teaching. During her interview, she mentioned that she would not have decided to teach abroad if it had not been for her experiences in the 2017 program.

4.2.2 Study, reflect, learn

While abroad, Andrea's confidence grew as a result of connecting with others, trying new things, and experiencing life abroad during her hours alone. She had a sense of self efficacy and a belief she could accomplish tasks she normally could not do or would not try to complete in the US. She was able to challenge her own perceived limitations. After the trip, Andrea became more open to experiences, more willing to take calculated risks, and more open to spontaneity. Ultimately, she became more comfortable connecting with others, and as she shared, she now sees that "we're all interconnected in some way."

For Andrea, the study abroad experience allowed her to evaluate herself and her cultural identity as a Latina American. "I guess before I went to (university) I have never really thought about my culture or I guess maybe meeting other people from different cultures and interacting with them." She shared how this was prompted by her ease of conversation about issues with her Dutch peers during a cross-cultural education experience. This disorienting experience led her to examine herself in relation to her Dutch peers. In turn, she acted on her revised understanding of intercultural communication and her ability to communicate with others by pushing herself out of her comfort zone and taking action to continue gaining new knowledge and skills from her new Dutch friend. She told about how at the end of the day-long intercultural experience with the Dutch preservice teachers that she finally asked to connect with one of the students via social media. This connection allowed her to be in continued conversations with this student. Because of the bold move to ask to connect, she met up with the Dutch student a number of times to talk, explore Amsterdam, and experience a karaoke night together. This provided

her with a "cultural translator" [4], increased her access to the Dutch culture, provided her with a richer experience beyond the prepared activities of the program, and in turn changed her cultural frame of reference about intercultural communication and the Dutch culture. Making new friends was one skill Andrea mentioned as making an impact on her experience abroad. She has continued communication with at least one of the Dutch students. They speak periodically over social media. She shared another example about how she connected with one of the refugee students and then attended an Afghan night sponsored by a local Afghan group in the Dutch city.

Andrea was also able to transcend her ethnocentric worldview [11] because of her time in International Schools and interacting with Dutch students. Because of the program abroad, Andrea became more concerned with the events that were happening overseas. Her thoughts on culture and her worldview have become more congruent with her newly developed assumptions and perspectives leading her to take a more ethnorelative stance.

4.2.3 Perform/pedagogy

During the interview, Andrea mentioned speaking with an American international teacher in a German International School. After that conversation, she realized that like this teacher, she could also see herself as a teacher in an international setting. After this, her identity as a teacher began to shift. "I guess in relation to me teaching abroad, it was when we met a woman teaching in Germany. And she's from Frisco. So right next to my hometown. "So, for me that was a wakeup call is just to, oh my gosh, this is possible." She decided to pursue international teaching. The February after her study abroad experience, Andrea attended the International School job fair. During the fair, she was able to connect with a school in Honduras. In response to experiencing different cultures abroad. Andrea's career trajectory changed during the study abroad program. "(I) wouldn't really have considered teaching abroad if I wouldn't have gone on this."

Andrea emphasized the importance of culture in the learning process. Being a teacher at an International School has helped her focus on students and their individual needs. She found it necessary to mine for information or pull information out of her students [3] to better serve them. "I would say I'm trying to bring in different cultures into my teaching. I'm trying to see, okay, where are my students coming from, what are their experiences like?" She was more aware of her students' previous cultural knowledge and how that impacts her teaching practices. During the first few months, she found a few ways to integrate learning about culture into her lessons. For instance, she found a video that followed students from different cultural backgrounds around their daily lives. She showed her class the videos and had them answer questions such as "How is this person's life different from yours? What did they do? What did they like? How is this person's life the same as yours?"

This practice helped her students become curious about the concept of culture as it influences worldviews and understanding. As she continues to improve her teaching practice, she plans to continue including global education examples and experiences into her teaching.

Andrea, as a way to be a member of her new community, challenged her own assumptions by pushing herself out of her cultural comfort zone. For instance, she visited a mountain village with a few of her teaching colleagues. During the experience she was curious about the openness of the houses (i.e., no doors on bedrooms and bathrooms) and the way the people of that village interact with each other. Andrea continued to question her previous understanding of Honduran culture as she traveled through the country.

4.3 Tanyia

"I realized how we have to take care of the world" Post Interview [2019].

4.3.1 History and context

Tanyia was 26 years old and grew up in the US in the fifth largest metropolitan area in her southeastern home state on the Atlantic coastal plain. She taught fourth grade for 5 years in two of the largest cities in her home state. Robinson Elementary, located but a short block away from one of the city's main thoroughfares, is where Tanyia currently teaches fourth grade, a Title 1 public elementary school. The school's racial/ethnic breakdown is over half African American, a quarter Hispanic, and a mix of other races—similar to the racial/ethnic makeup of the surrounding low-income residential community where Tanyia's students lived.

As an instructor, I met Tanyia 2 years prior to her participation in the Manú program as her instructor in her science-focused Teacher Education cohort at one of our state's largest public universities. Tanyia stood out as keenly intelligent with a true understanding of science, which she often shared with the cohort class. She was self-assured, knowledgeable, and competent in teaching science in her internship at a local science magnet elementary school.

Tanyia also instinctively stood up for the oppressed and was culturally competent. During an advocacy exercise in a cohort seminar course she chose to share her first-hand knowledge of the lag-time of police response to 911 calls in her Black neighborhood. By choosing this issue in 2014, she chose a more controversial race-based community problem to advocate for in a class where others identified issues experienced by most college students, such as problems with the parking system on campus. Tanyia naturally had a marginalized frame of reference in addition to well understanding the dominant White culture in the South.

4.3.2 Study-reflect-learn

Tanyia recalled how "fresh" the Manú jungle was because it had hardly been affected by humans. Then she caught herself as she remembered there were some humans in the jungle, because, as she said, some tribes had chosen to stay there. She noted that the trip to Manú did boost her cultural awareness. "I was always out of my cultural comfort zone on that trip, this was the first time I'd travelled outside of the country without my family," she said, "without anybody from my family with me, but that's how we learn, and I went out of my comfort zone". She had traveled internationally before going to Manú, but only on a family cruise to Mexico that was "geared to tourists".

The trip to the jungle was a disequilibrium triggering event for her, wrought with new and overwhelming experiences in the wild for most participants. Hiking in the jungle was not always easy for Tanyia. One day she asked if she could stay in her room instead of hike. We required the whole group participate in each EE activity the lodge organized for us, but she had swollen ankles, her feet hurt and were blistered from walking so much, so we thought it was better for her that she stayed back that day with one of the grad students. But, after the trip to the Manú Rainforest she was confident enough to travel abroad again, and "stayed with the locals" in Aruba.

What stood out to her about the Manú program was socializing on the trip. She remembered trying to communicate as best she could with the people that worked at the lodge in the jungle at the Manú River site. As she reflected upon her experience, she said it "opened her mind" when she saw how different people lived. "I just

saw how different it was, and how people, even if they do things different, that's not bad" she said, "it's just different".

4.3.3 Perform-pedagogy

In her post interview, Tanyia said that study abroad did influence her teaching. Her favorite part of the Peru program was interacting with the kids at the Lima school, seeing how they do things there, and having lunch with them. In the jungle she said, "We talked with the people who worked there (at the birdwatchers lodge on the Manú River)... I'm still Facebook friends with Guillermo (one of the guides)... he's some kind of bird specialist". She shared stories about her study abroad travels with her fourth grade class in the US, and noted that some of her students have not traveled; they have not even been to big shopping centers in their city close to where they live She said that her students consider her well-traveled. Tanyia also had some of her students take action and "send off" to help preserve the rainforest as part of her pedagogy, teaching them to "take care of the world", She tells them her story of how big the base of the Kapok tree is, "as big as this classroom", and how a fellow student in study abroad stood in the space between the roots at the base of the Kapok tree and bats flew out. She deeply understands her students' lives, and helps broaden their cultural and environmental awareness and knowledge with amazing true stories from her travels.

As to her personal aspirations for the future, Tanyia is currently seeking a Master's degree, and she expressed on social media that ".. . there are other things more important to me, like being called Dr. Jones one day."

4.4 Lucia

> *"Before the trip, I didn't understand the complexity of how the world really works, and the complexity of just,... life itself." Post Interview [2019].*

4.4.1 History and context

Lucia, 28 years old, self-identified as Latina, and identifies strongly with her country of origin, where she immigrated from to the US and still has family, and is bilingual in Spanish and English. She had visited Columbia in the past, while a child growing up in the United States. She said, "It's been for me, something that I've always kind of struggled with... am I American or am I Colombian?" Her frame of reference before traveling to Manú was multifaceted.

As an undergraduate, Lucia interned and student taught at a science magnet elementary school as part of a science-focused cohort in her K-6 licensure program in Teacher Education at a large public southeastern state university. She was not one to take on leadership positions in her cohort. Neither was she one to shirk her share of the load as she worked hard in designing her science lessons. She had developed superior pedagogical skills in setting up science inquiry lessons by the time student teaching was over.

She taught 6th grade science at the largest middle school in her metropolitan district. Academic tracking was utilized in her school (⅓ high, ⅓ medium, and ⅓ low tracks in each grade). Lucia taught what she referred to as the "low" group. Most of her students were youth who came from feeder Title 1 elementary schools, and the majority were African American, with a large percentage of Latinos. New immigrant students were often assigned to her class as her school district did not have a designated school for new immigrants.

4.4.2 Study-reflect-learn

"I would say, just my worldview, and how big the world really is changed" after the study abroad trip. For Lucia, the size of the knowable world literally grew before her eyes in the jungle. She remembered sitting out on the dock on the river at the birdwatcher's lodge near the Manú Rainforest Preserve and looking up to a clear night sky unhampered by lights on Earth and seeing many, many stars. She said she had never seen anything like it before or since, and that she felt small, "in a good way", with the full expanse of the universe before her, visible.

Nature and culture in Peru were both different from what she knew in the United States or Colombia. It was disorienting "... with just the exposure of seeing other cultures and knowing what it feels like to not be of that culture, and not really understand what's going on. And then, now you're here, you're immersed in it,... you're trying to navigate". She was making her way through new experiences. She said, "I think it (the trip to Peru) was one of those things too that kind of helped me also learn how to navigate between cultures as well. Because at the end of the day, I did grow up here in the United States. And so, I understand the cultural group that I'm coming from that I'm with. And then, also navigating between that cultural group with this new cultural group that we're immersed into".

Through her assignment teaching a lesson she had designed, a read aloud, at the EE fair at the K-6 primary school, Lucia developed empathy for her classmates and other study abroad students there with her who did not speak Spanish. "I can empathize with people not knowing any of the language whatsoever, and feeling completely lost" she said, "So it did help a lot being able to speak the language. And also, connect with the kids, just because I was able to have actual conversations with them, instead of just trying to figure out what you're saying" She knew that others in the group who could not speak Spanish could not figure out what the children were saying, if they spoke in Spanish. "So," she said, it was, "... me just wanting to help people navigate, because I understand that it's not an easy task." She commented that it wasn't that she wanted that role or sought to be a leader, but because of her empathy she took on the role of interpreter for others in the group. She realized it was hard for others in the study abroad group to navigate between cultures, and she felt that by doing so, and doing so for others, this helped her develop intercultural competencies.

4.4.3 Perform-pedagogy

Lucia was able to connect with new immigrant students, and she linked this ability to how she was able to connect with Peruvian students at the school we visited in Lima. Though she spoke Spanish fluently and had lived in and visited Colombia, she was still challenged by immersion in Peruvian culture, and connecting with the Peruvian students was not simple, so this connection was one of her proudest memories. She mentioned it repeatedly. She also developed an awareness of nuances in the cultural differences between herself and her new immigrant students. She pointed out that one of her students, from a Central American country that spoke Spanish, was of native descent and did not speak Spanish. She also noted that "...yes, I have an added advantage (in Peru) because I can speak another language, but even within that, my dialect is different. Our cultural forms are very different. So, I think being able to connect with those (immigrant) students (in my classes) in a more meaningful way had a lot to do with my trip to Peru."

She felt it was an achievement to be able to connect with her students from many different cultures, even with students from countries that did not speak Spanish. "I feel as though I'm open to other cultures and experiencing learning. And

that to me is what's important, is being open-minded and really wanting to learn and be mindful that just because your culture is different than mine, doesn't make it wrong." For instance, she shared how she went to an Ethiopian fair and ate a dish one of her immigrant students from Africa enjoyed, and she was able to connect with the student by talking about the dish.

"A lot of these kids... are not even aware that these things exist, that these can happen..." referring to what she saw and experienced in Peru, "... any of that, because they're so caught up in whatever is just in front of them" she said of her students.

"So had I not had that experience (in Manú) I could have been like them, and not understood the importance of taking care of our planet and doing our own part– and how even if it's just that one little part that we do, it still contributes... And so, it's really important that they hear it from a (witness). Look, I actually went. I actually know about this. I've seen it. It gets them excited, it gets them to think outside of what they've been ... exposed to already, because they haven't been exposed to much of anything else."

Lucia's recognized identity was as a cultural leader during the study abroad trip to Peru, as she was one of the few Spanish-English bilingual participants. In the jungle when we had to split the group of 29 people into 6 jeeps to cross a remote land bridge between boat rides on the river, Lucia was the assigned Spanish speaker/leader in one of the jeeps, even though she was an undergraduate student. In addition, she noticed that other students turned to her when they did not understand what was being said around them. She felt she had to continually "negotiate" this space between two cultures and languages while in Peru.

Lucia admitted that she was not a leader when she was an undergraduate preservice teacher, but she became a recognized leader at the middle school where she worked, as well as in the school's Spanish-speaking community. She was called on frequently to communicate with Spanish-speaking families, as she was the only staff member who spoke Spanish. Lucia finished, as she put it, her "last" year of teaching in 2019. She will finish her Master's program in educational administration in 2020, and then planned to spend some time in Colombia before going back to the elementary school level as a principal in her home state. She noticed there are not too many Latinas in administration, so she wants to move into that career. Study abroad, Lucia said, "Literally changed my life. Seriously, I'm so serious. When people ask me (what's) one of the most important pivotal experiences of my life, (Manú) that's literally one of them... it completely changed my life.. . I remember everything. I talk to my students about it all the time".

5. Findings and discussion

Our data evidenced pronounced lasting effects of study abroad, especially increased cultural awareness, knowledge and skills [25]. Our participants described their study abroad experiences as transformational learning. The experiences that were mentioned the most were cross-cultural social interaction and intensive school visits with opportunities to teach. These experiences are examples of disequilibrium or triggering experiences that elicited in all four teachers a reevaluation of existing cultural assumptions. Our study points to the necessity of creating thoughtful experiences abroad that push students outside of their cultural comfort zone to explore a new culture in order to experience dissonance for cultural learning. In addition, our findings indicate the strong importance of guided reflection and discussions that helped students to retrospectively analyze and examine their assumptions and knowledge about culture. The combination of disorienting experiences and thoughtful reflection promoted transformational learning outcomes

that capacitated the development of cultural awareness and cultural competence. This, in turn, had positive impacts on reflection skills, curiosity, and a new conception of how culture influences knowledge construction, further leading to the development of culturally relevant teaching practices, as was evidenced in teachers' narratives of their pedagogical actions and decisions. The findings suggest implications for other teacher education programs interested in using study abroad experiences in their programs to promote teachers' development of culturally relevant pedagogy [3].

5.1 Transformational learning

5.1.1 Phase 1: disequilibrium experiences

Cultural competence does not just happen because someone travels abroad. It must be developed, cultivated, and tended to through intentional planning and action. A well-executed study abroad experience gives students the opportunity to have an experience that expands their perceptions and makes them feel dissatisfied with their existing understanding. Both programs provided participants with disorienting, cultural immersion experiences that led to disequilibrium [4, 10, 18]. In the Maastricht program the teaching experience at the Refugee School and the intercultural interaction with Dutch preservice teachers had an impact on both Devon and Andrea. On the Manú trip, Tanyia and Lucia found that navigating cultures and learning about hidden cultures were experiences that triggered dissonance and wonder. These experiences were powerful in the way they were executed. The program designers provided opportunities for their preservice teachers to experience cultural dissonance [5, 10] in turn exposing participants to their own cultural assumptions, some they may have been blind to. As evidenced from our study, any teacher education program that wants to cultivate intercultural sensitivity, cultural competence, and awareness in their preservice teachers needs to create extensive intercultural immersion experiences for their participants [5].

School visits proved to be experiences that exposed discrepancies in the preservice teachers' views on culture, teaching, and learning. The Refugee School experience was culturally disorienting to Devon [6]. He developed a new frame of reference after discussing life with the students at the Refugee School [10]. In turn, he began to question the US media and his own views on refugees and immigration. In essence, Devon began his critical stance of the knowledge [3] portrayed by the US news media. This was the first step to thinking critically about cultural knowledge and could be translated to his students and their sociopolitical situations.

Social interactions in cultural immersion were challenging for our participants, who had traveled little or not at all internationally before study abroad. Andrea experienced disequilibrium as she interacted with the Dutch people. Her initial exposure to a new culture and people who were different from her caused her to consider herself a cultured being with certain views and perspectives shaped by her context and experiences from a new frame of reference [10]. The local people that students communicated with on study abroad trips were in effect cultural translators [5], and as such they were a key component to making sense of new information about culture. They provided participants with a person who could answer questions about assumptions, and could provide context to triggering experiences, further enhancing the chance for participants to learn new knowledge and skills such as intercultural communication and inquiry.

Intercultural interactions during study abroad provided opportunities for participants to acknowledge and grapple with cultural nuances, such as language dialects. For Lucia, the Spanish spoken in Peru was disorienting as it was different

from her Columbian Spanish. It was helpful to her as a future teacher to learn to be a 'cultural translator' [5], interpreting while in cultural immersion for herself between her own culture of origin and that of Peru; and then interpreting for herself and for others in the group between the US dominant culture and the Peruvian culture. She reflected in her interview upon the fact that she had developed intercultural competence [2] because she realized that her Spanish dialect was distinct from the dialects used in different regions of Peru, and that there were cultural norms in Peru which varied from those in her country of origin and the US, all of which she had to "negotiate" during study abroad. The ability to acknowledge nuanced cultural differences is a valuable skill for teachers in diverse school districts with a variety of immigrant students from recognized language-dominant countries possessing varying dialects and/or subcultures.

Cultural learning experiences, such as watching and discussing a video about tribes in Manú protesting against the Peruvian government's attempt to develop an area of the jungle where they lived, were triggering experiences for Tanyia that led her to question her initial assumptions about the jungle being devoid of humans. In reflection, she adapted her schema [18] to include the Manú tribes living deep in the preserve, even if she had not seen them, or the effects of their living there. She caught herself during the post interview when she said that the jungle was "fresh" and unaffected by humans. She then immediately changed her frame of reference, prompted by the documentary we viewed during the trip one evening at the birdwatcher's lodge with one of the guides, to include the local native tribes as humans who chose to live there, and who could affect the jungle, even if minimally, and even if they were trying to save it as a natural preserve. This activity pushed students to develop sensitivity to the existence of varied sociopolitical epistemologies by bringing to light the viewpoints held by native tribes that had been hidden even to local politicians in Peru, until they protested against economic development of their rainforest home.

5.1.2 Phase 2: critical frame of reference

Cultural disorienting experiences abroad are not sufficient for cultural competence and awareness to develop. Thoughtful and intentional reflection is a mandatory next step [5]. Each program provided participants with opportunities to examine their perceptions before, during, and after the experience. Participants were asked to reflect upon their own culture and the host country's culture a number of times. The essence of the critical viewpoint is much like what Devon mentioned during his interview: "I think just sitting and letting it stew a little bit and letting those ideas' kind of, sit, and develop over time has obviously positively changed my life for the better."

The study abroad course curricula in both programs allowed students to reflect, share their feelings, and be critical of their assumptions [1, 4]. This process of reflection allowed participants to become more culturally aware, thus making cultural comparisons and learning to be critical of their own culture, reducing, in effect, their ethnocentrism [26]. During the Maastricht program, the video log assignments were crafted to elicit a critical viewpoint on the participants' global competence development and the emotions that surfaced during culturally unfamiliar situations, while an essay project required participants to inquire about culture or education related topics that made them curious. In the Manú program, participants were asked to reflect on their experiences abroad by journaling daily and then participating in guided discussions with faculty and scientists.

Assignments before traveling, such as the assigned reading about the role of trees in the making of America, acted to set up a more informed frame of reference

[10] in the United States for students. The assignment introduced a critical view of deforestation in the United States, and as such helped prepare students for a better informed and critical view of proposed destruction of the rainforest home to native tribes in Manú, as portrayed in the documentary we viewed and discussed while on site near the natural preserve. Teacher educators can intentionally set out to help students with growing their cultural awareness through carefully planned experiences and assignments.

Critical reflection was required in assignments. After experience visiting two starkly different schools in the Netherlands, Devon began to critically reflect on the global inequalities that exist in education. After talking with a refugee student, he became increasingly critical of the American media's view on immigration and his existing perspectives on refugees in the US. Even before study abroad, Tanyia had an informed critical view of US mainstream culture, and she was not afraid to share her own interpretations publicly, so her willingness to see and share her critical cultural stance well prepared her for taking on a critical view of how mainstream culture may see Latin American cultures or native cultures in Manú in her reflections and discussions during study abroad. Tanyia took on a critical view of mainstream negative views of Latin American culture in the US at the time. She found new cultures she encountered in Peru were different and not to be considered as less, but as she said, "just different". Taking on a critical stance of cultural assumptions happens when students are asked to compare those assumptions to real experiences. In this way stereotypes are revealed as such.

New cultural self-awareness, when participants realized that they too had a culture of their own with certain perspectives, traditions, and ways of being, was prompted by school visits and socialization. Through the auspices of a cultural guide, a Dutch preservice teacher, Andrea's new realization of her own heritage and culture led her to reflect on her identity as a Latina American. As an in-service teacher, in order to better serve her students, many who were from Honduras, she went on to critically assess her assumptions about Honduran culture. She had recently explored a Honduran mountain village. In doing so, she continued to seek perspective consciousness [27] and continued to develop her cultural competence [4]. This provided continued evidence that the skills developed during an education study abroad experience can have far-reaching impacts on classroom teaching and learning.

5.1.3 Phase 3: changes in viewpoint and future plans

Through the use of guided reflection and retrospective research methods we were able to examine how the teachers felt that the study abroad experience was transformational, helping them gain new knowledge and skills, and a more critical awareness of culture and its effects on pedagogy. This learning, in turn affected their teaching practices. Learning from a study abroad experience does not end after a study abroad program has ended the impacts are much more long term [16]. Based on our findings, we suggest the impacts of teacher education study abroad should be analyzed years later to examine the greatest impact on teaching practices.

We connect transformational learning to performance and culturally relevant pedagogy [5]. Essentially, a change during transformational learning can lead to a change in performance, either within teaching practice or in daily practice. Devon, Andrea, Tanyia, and Lucia all reported some form of transformation directly related to their undergraduate teacher education study abroad experience.

The new knowledge, skills, and awareness gained from the study abroad experiences led to meaningful engagement in communities and new cultures years after participation in the study abroad experiences. This form of engagement was an

essential part of both study abroad programs. Through planned activities in each programs' study abroad curriculum, preservice teachers stepped out of their cultural security zones to engage with local people on their own, overcoming cultural and language differences, learning to communicate with people from different cultures who spoke a different language or dialect. Cultural immersion prompted them to adopt a new frame of reference [7] when they realized through intercultural comparisons that they had a culture of their own, and a dialect of English or Spanish of their own. Cultural immersion with the support of guided reflection in the form of video logs and journal writing forced participants to acquire new knowledge in order to function, leading them to change their thinking about culture and its effect on their ability to connect and communicate with others around the world. As teachers, Devon, Andrea, Tanyia and Lucia continue to deliberately make efforts to be a part of their local communities [3], and in particular the new immigrant cultures within.

Global perspectives of education are not easy to take on without international travel to schools, as Devon expressed in his interview. Experiences such as visiting and teaching at schools abroad prompted a transformed cultural awareness of the larger implications of education as a global imperative, not merely a local mission. Teacher educators want students to grapple with ideas about the purpose of an education and social justice as they move through their respective programs [5]. Observing teaching styles and the mechanics of teaching were important learning opportunities for Devon. His experience with the Refugee School and the private International School impacted him by transforming his views of what effective culturally responsive teaching should include for optimal student success. As he said, "Really (the study abroad experience) just kind of readjusted the idea of what good teaching is, and what responsible teaching is, and what responsible cultural pedagogy and curriculum is, and things like that. So, it was very beneficial to me, even at such a young age, cause I was only nineteen during that time." This acquired view of education prompted him to pursue a Master's degree in Curriculum and Teaching with an emphasis on cultural and socioeconomic components of teaching and learning further enhancing his understandings of cultural competence and how that correlates to classroom practices at a diverse urban school.

Seeking out new cultural experiences was an activity we as teacher educators included in our study abroad programs, hoping to assist students in reaching out to the international communities we visited, hoping they would forge relationships based upon meaningful understandings of other peoples' similarities and differences to their own culture [4]. We found overwhelming willingness on the part of interviewees to still engage in new cultural explorations in the years after their study abroad experience, in personal life and in both the classroom and through personal relationships with students and their families. Devon moved beyond his cultural comfort zone to attend a student's confirmation. Lucia tasted an Ethiopian dish that one of her students knew of and could bridge cultures by talking to him about it. Most notably she transformed her sense of confidence after the roles she took on negotiating cultures and as a bilingual interpreter in Peru [4] and became a valued cross-cultural expert at her school as the only interpreter and translator for Spanish-speaking families in her school community. Andrea continues to experience new cultures and works to be a part of her new Honduran community. She became aware of her ability to effectively interact with new cultures and explored her new role as an intercultural communicator by befriending others from other countries [28]. Tanyia said the most rewarding part of the trip was visiting the local school in Chorrillos where she taught and socialized with children all day. She said she would have liked to have had another day there. She later traveled to stay with the "locals" in Aruba, instead of in tourist areas, as she had in the past when she traveled with her family, and she shared stories of her experiences with her students. Seeking out

new cultural experiences after their study abroad showed, as multiple participants described it, an "open-mindedness" to cultural differences.

5.2 Cultural awareness, competence, and relevant pedagogical practices

To become more culturally competent teachers, those who incorporate culturally aware plans and actions in pedagogy, study abroad participants can utilize their increased cultural awareness, knowledge and skills that they found that they gained through transformational learning from their study abroad programs. All four of our study participants coincidentally sought out/chose challenging positions for these first few years of teaching, either going abroad to teach or teaching in a high needs urban diverse classroom. All four were from minority and marginalized populations in the teaching profession (Male, Mixed Race, African American, and Latina), but this alone did not prepare them to be culturally competent teachers in these complex contexts. Study abroad experiences, for these teachers, were pivotal through transformational learning towards cultural competence in their teaching practices.

While we as teacher educators can implement classroom activities [29] that promote cultural competence and awareness without study abroad, what is difficult to do in class is to provide lived experiences within another culture. We found that lived intercultural experiences significantly increased cultural awareness for our study participants. Overall, participants realized the interconnected nature of the world after study abroad. This shift in increased cultural consciousness is a strong indicator for culturally relevant/responsive teaching [4, 5, 30]. This happened in part by offering them opportunities for reflection in journals and discussions, making visible new frames of reference from which to critically view alternatives to their own lives and culture, by showing them different social structures, and by presenting different epistemologies, in alignment with three elements of culturally competent teaching, as per Ladson-Billings: "Conceptions of self and others. .. the manner in which social relations are structured... and conceptions of knowledge" [3], p. 478.

Conception of self as a capable professional and others as capable learners are cultural competencies that we as teacher educators hoped to model and support in our programs. As an after effect of study abroad experiences, researchers found that students feel an increased sense of self efficacy and confidence in their abilities [4, 7, 28, 31], and our findings supported this. What was transformational about study abroad for preservice teachers was carried forward into professional life and practices in the classroom. Teachers in this study, once back in the US, were aware of the cultural heritage immigrant students had, the limited cultural experiences some of their students had, and recognized in themselves the broad experiences they had gained. Ladson Billings described culturally relevant teachers as "risk takers." [3], p. 479. We, too, would describe our study participants as risk takers. They were willing to step outside of themselves to teach at low income, Title I schools or international school. They were also willing to learn new things and have new experiences to better serve their students and their school districts. Lucia saw an all Latin American teaching and administrative staff at the school we visited in Peru, and subsequently became culturally aware of how few Latinas there are in teaching and administration in schools in the US. From taking a back-row seat in her undergraduate cohort courses and quietly minimizing her participation in class, to being recognized by her colleagues and administrators as a trusted leader and invaluable in communicating with Spanish-speaking families, Lucia's trajectory evidenced increased cultural awareness, knowledge and skills. She evidenced an incredible character change from her preservice teacher days, seeking leadership roles as she planned to work as a school principal upon completion of her Master's degree. She attributed her first step towards her new career choices to the

experiences she had on the trip to Peru, "I've never sought out to be like, 'Oh, I'm going to be this leader.' And now, five years later, I'm going to be... the leader. The trip to Peru," she said, "was that stepping stone into the next direction of my life." Andrea also experienced transformational learning in response to her experiences in Europe. She began to behave and think in a way that was more congruent with her newly acquired cultural perspectives [4, 10].

The manner in which social relations are structured is important to culturally relevant pedagogy [3] Reaching out to socialize with students at schools we visited, finding ways to explore cultures, were common practices during study abroad. Devon, Andrea, Tanyia, and Lucia deliberately made efforts to be a part of their school communities as teachers and explore different cultures within their communities [3]. Study participants had developed intercultural sensitivity [4] to the differences there were between their cultural backgrounds and the cultures they encountered while on study abroad, and later between their culture and the cultures in their communities and classrooms. This deeper understanding, cultivated from the study abroad experience, led them to be a part of their community by attending student activities outside of the school, exploring different parts of the community, or as in Lucia's case, serving as an interpreter to assist students and their families. All of which helped to "maintain a fluid student-teacher relationship" [3], p. 480 that does not end at the classroom door.

Evidenced by the teacher narratives, we found conceptions of knowledge as global, able to be understood from multiple epistemologies, and not static but constructed [3]. They thought that multiple forms of knowledge should be valued in the classroom and beyond. In addition, these participants also brought their new ideas and study abroad experiences to their classroom pedagogy, enhancing their curriculum and the relationships with their students. Tanyia became more aware of biodiversity through lived experiences in the rainforest, and her world view became increasingly complex [28]. This new cultural awareness of the jungle context became part of her pedagogy. She stood under an enormous Kapok tree and could describe the experience to her students. She was more aware of nature conservation and of the local tribes in the Manú preserve who fought to save Manú from the Peruvian government's land acquisition and resource exploitation efforts. Lucia's new knowledge of native South American culture was an awareness she could also use in her classroom. Students from native cultures unfamiliar to her were arriving in her classroom. She developed the skill to recognize students who were from native populations, such as from indigenous Central American populations. She was aware of students who did not speak Spanish but were from Spanish-speaking countries, even if those of the dominant culture in their country of origin were Spanish speakers. Her deeper knowledge of native cultures and recognizing cultures espoused by new immigrant students arriving in her classroom in the United States was, as she described it, helped by what she learned on the trip to Manú.

Cultural awareness, knowledge and skills mentioned by the teachers in our study can be considered stepping stones along the path to cultural competence and culturally relevant pedagogy [3], which we would expect them to develop further over time. Andrea was in her first year of teaching, and the other three teachers in the study were in their third and fifth years of teaching while pursuing a Master's degree at the time of their post interviews.

6. Conclusion

We found that engaging preservice teachers in deliberately designed study abroad programs to culturally new settings was transformative. Our participants

discovered what they could only imagine before, and these discoveries grew to become new perspectives positively affecting pedagogies and actions in the classroom and their career trajectories. Our findings show that these cultural immersion experiences in the form of short-term faculty led study abroad programs had a lasting impact on the development of our participants as culturally relevant teachers, which is still felt incrementally and articulated by the participants years later. The preservice teacher participants shed their cultural blindness by analyzing their culture while being in the context of other cultural behaviors and ways of doing things. The preservice teachers began to see knowledge as something that is influenced by culture and context, and became critical of the way knowledge was communicated, valued, and transferred. We suggest study abroad experiences are essential to developing the skills necessary to develop culturally relevant teaching practices. In particular, the ways preservice teachers conceive of themselves and others, the way they socialize and communicate, in the way they view knowledge, and in how they value different ways of perceiving the world.

Study abroad experiences paired with mindful activity and reflection are propitious components for training preservice teachers to be culturally relevant practitioners. Transformational learning opportunities abroad provide preservice teachers with the experiences, knowledge and skills necessary to reduce ethnocentrism, and helps them become aware of their culture, and how culture affects worldviews and learning. These cultural immersion experiences can assist preservice teachers in developing the skills necessary for cultural competence that leads to culturally relevant teaching practices—uniting cultures they find in others into a multifaceted prism reflecting their own illuminations, so as to light up the room and help prevent cultural blindness.

Acknowledgements

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Appendix: interview template

1. Race/Ethnicity
   a. White or Caucasian not Hispanic/Latino
   b. Black or African American
   c. American Indian, Alaska Native
   d. Asian
   e. Native Hawaiian or Pacific Islander
   f. Hispanic/Latino
2. Gender/Sex;
   a. Male

b. Female

c. Do not want to share

d. Other

3. Age;

4. Where teach/work? grade/job description;

5. Highest degree;

a. Associate's Degree

b. Bachelor's Degree

c. Master's Degree

d. Doctoral Degree

e. Professional Degree

6. Years teaching;

7. Traveled before study abroad trip?

8. Traveled since study abroad trip?

9. What do you remember about your study abroad experience? What stories do you most often share with others about your study abroad experience? Why was this important to you?

a. Prompt memory of trip with some events that happened on the trip (e.g. migrant school visit, charity school visit)

b. Prompt detail with, "Could you tell me more about this?", or "Could you give me some details?"

10. How would you describe yourself in relation to the world before your trip? After your trip?

a. Do you identify with one specific geographic place on earth, or more than one? How? Why?

b. Do others see you the same or differently since your trip? If different.. .

i. Would others see you as an "environmentalist"? (remind interviewee of an event on the trip that was environmentally focused) Why or why not?

ii. Would others see you as "cultured"? (remind interviewee of an event on the trip that was culturally challenging) Why or why not?

c. Do you feel you identify with a specific place on earth? Where? Why?

d. Do you think your study abroad experience influenced/changed your life? Why or why not? In what ways? If yes,

i. Describe one example of how your experience influenced/changed your life.

ii. Did a new awareness have something to do with it? If so, please describe.

iii. Did new knowledge and/or skills gained through activities have something to do with it? If so, please describe.

iv. Did your experience change your perspectives on

1. Perspectives on education?

2. change your teaching?

3. If so, did new awareness have something to do with it? If so, please describe.

4. If so, did new knowledge and/or skills gained through activities have something to do with it? If so, please describe.

11. Do you think your study abroad experience influenced your teaching?

a. If yes, how has this experience influenced your teaching? Describe one way in detail.

b. If no, why not?

12. How do you seek out experiences that take you out of your cultural comfort zone?

a. Describe one experience since your study abroad, in which you were out of your cultural comfort zone.

13. How did your study abroad experience take you out of your cultural comfort zone?

a. Describe one experience where you were out of your cultural comfort zone

14. Have you shared your study abroad experience with your students? If so, what stories have you shared?

15. Have you taken any action to preserve or protect the environment since your trip?

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Author details

Allison Freed[1*], Aerin Benavides[2] and Lacey Huffling[3]

1 University of the Ozarks, Clarksville, AR, United States

2 University of North Carolina at Greensboro, Greensboro, NC, United States

3 Georgia Southern University, Statesboro, GA, United States

*Address all correspondence to: afreed@ozarks.edu

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Chapter 10

Categorization of Educational Technologies as Related to Pedagogical Practices

Perry P. Gao, Arvid Nagel and Horst Biedermann

Abstract

Educational technologies are not homogeneous. This chapter proposes a framework to categorize various technologies in the K-12 educational setting into groups of operational technologies and pedagogical technologies by whether they directly participate in the process of teaching and learning. Furthermore, pedagogical technologies are split into tool-based and program-based technologies based on whether they are teacher-driven tools or algorithm-driven learning programs. Efficient adoption of tool-based technologies requires a redefinition of learning goals to embrace student-centered education. Program-based technologies need more research to be fully understood and improved, and current ones are under-researched and fail to engage and motivate students to learn.

Keywords: educational technologies, pedagogical practices, teaching and learning, artificial intelligence

1. Introduction

In 1994, when computers had just begun to be accessible to regular classrooms, an article titled "Why Use Technology?" was published [1]. The authors, Kyle Peck and Denise Dorricott, began the article by asking the question "If we removed all of the computers from schools tomorrow, would it make a big difference in the knowledge and skills students demonstrated upon graduation?" They answered, "Probably not." In the minds of Peck and Dorricott, the introduction of computers in K-12 schools did not create an electronic highway of accelerated learning but rather a dirt road without clear expectations or purpose. More than two decades have passed, and in that time, technological progress has surpassed anyone's imagination. Technologies are more capable, diverse, and accessible than ever. However, if we ask the same question again, we believe the answer is still no. This is probably because the pace of school reform is far behind the pace of digital progress. The techniques and tools that are used by today's teachers to achieve learning goals are not fundamentally different from the ones used in previous decades [2]. Teachers use *Google Docs* to replace printed worksheets and documents, use videos and *PowerPoints* to replace handwriting and drawing on backboards, use text messages as an alternative to traditional communications, and use digital student records instead of hard copies. Based on a 2017 report on a national survey, the aforementioned uses of technologies have comprised the most popular educational

Figure 1.
Percentage of K-12 teachers engaged in the use of technologies in the USA. Note: Data source from Project Tomorrow's 2017 Report [3].

technologies in the US K-12 education [3]. Other more creative uses of technologies—such as guiding students to do digital investigations, creating videos of lessons, and making a class blog to enhance discussion—are much less popular among teachers (see **Figure 1**) [3]. Apparently, technologies have not fundamentally changed the activities of teaching and learning; neither have they brought much innovation into classrooms. It is true that technologies have been well integrated into science and engineering majors in higher education and now effectively help adults to fulfill self-learning through online courses on *Coursera* or *EdX*, for example. But somehow there is a decade-long struggle surrounding technology adoption in K-12 education. In order to make a breakthrough, we will take an in-depth look into current technologies that have been used in the education context and attempt to categorize them in relation to pedagogical practices. Thereafter, we will study factors that affect the use of technologies in different categories as well as explore the following questions: Can technology replace teachers? How can we take full advantage of the power of technology to improve teaching and learning in the age of digitalization and artificial intelligence?

2. Categorization of educational technologies

Digital technologies are very diverse—different technologies have unique functions and features that are distinct from one another, and hence, generalization should be avoided when studying the use of technology in any field. Unfortunately, most current studies on technology in the field of education regard them as a singular concept without making any distinctions among different kinds of technologies—as if all technologies are homogeneous. To correct this widespread and long-lasting oversight, we will attempt to categorize technologies that have been employed in educational settings.

2.1 Pedagogical technologies vs. operational technologies

Educational technologies can be categorized into two groups: *pedagogical technologies* and *operational technologies*. The first category refers to technologies that can be utilized in the process of teaching and learning. For example, teachers use *PowerPoint* presentations to deliver effective instruction, and students use the Internet to conduct independent research. Those technologies in the aforementioned uses are pedagogical technologies. The second category refers to technologies that are not directly involved in learning and teaching activities; instead, they assist in the operative or administrative part of teachers' work, such as using email

to communicate with colleagues and using an online data management system to keep student records. Those two categories are not completely distinct from each other. They could have some slight overlaps. For example, teachers can use some online learning management platforms to both keep assignment grades and simultaneously deliver feedback to students. Technologies are also interchangeable between the two groups—when *Word* is used to produce learning materials, it is a pedagogical technology, and when used to write work reports, it is an operational technology. The human use of technologies defines their essence. This categorization should only be considered in relation to a specific technology or a technological element under a specific use. It is hard to say which category of technologies is more popular in educational settings. It is also difficult to demonstrate which ones have a greater impact on teachers' daily work. But, for the purpose of this chapter, we only focus on technologies that directly influence teaching and learning—pedagogical technologies.

2.2 Tool-based technologies vs. program-based technologies

The process and resources needed for teachers to adopt technologies are qualitatively different across different kinds of technologies [4]. Countless individual technologies can be employed in pedagogical practices, and pedagogical technologies can be further categorized into two large groups: *tool-based technologies* and *program-based technologies*.

Tool-based technologies are the ones not specifically designed for education. They are merely tools that have been widely used in various fields, such as the Internet, *Smartboards*, and *Microsoft Office*, among others. Most technologies that have been widely used and studied in educational settings belong to this category. They came into education decades ago as society underwent digitalization. Tool-based technologies require teachers, either as individuals or as groups, to innovate and come up with designs and ideas to implement them in various teaching and learning activities.

Program-based technologies, on the other hand, are the ones that are specifically designed for pedagogical purposes with premade learning content delivered through algorithm-enabled instruction, such as learning games and online personalized learning programs that use artificial intelligence to give each student individualized academic exercises. They are often developed by companies and large not-for-profit organizations. They give classroom teachers less control over the design and content. They are designed to replace considerable portions of teachers' traditional work, such as delivery of instruction. Teachers and schools tend to focus on managing the logistics for the implementation of such technologies to fit into their learning goals. Program-based technologies are relatively new, emerging with the advancement of artificial intelligence. These technologies have received tremendous attention, largely due to Silicon Valley's increasing interest in this field. For example, *Facebook* founder Mark Zuckerberg, through his Chan Zuckerberg Initiative, developed the Summit Learning Program to promote online personalized learning of core subjects of grades 4–12 [5].

Digitalized contents, such as e-books, slide shows, *YouTube* videos, TED Talks, and online curricula teachers create or download online for self-learning or assisting teaching activities, are still considered tool-based technologies, despite their pre-made educational contents. They are created using tool-based technologies and rely on teachers to design their classroom use. The same logic applies to some learning management platforms that have been widely adapted, such as *Canvas* and *Blackboard*, to help teachers to assign homework and more effectively maintain online learning materials and students' records. Although they are made specifically

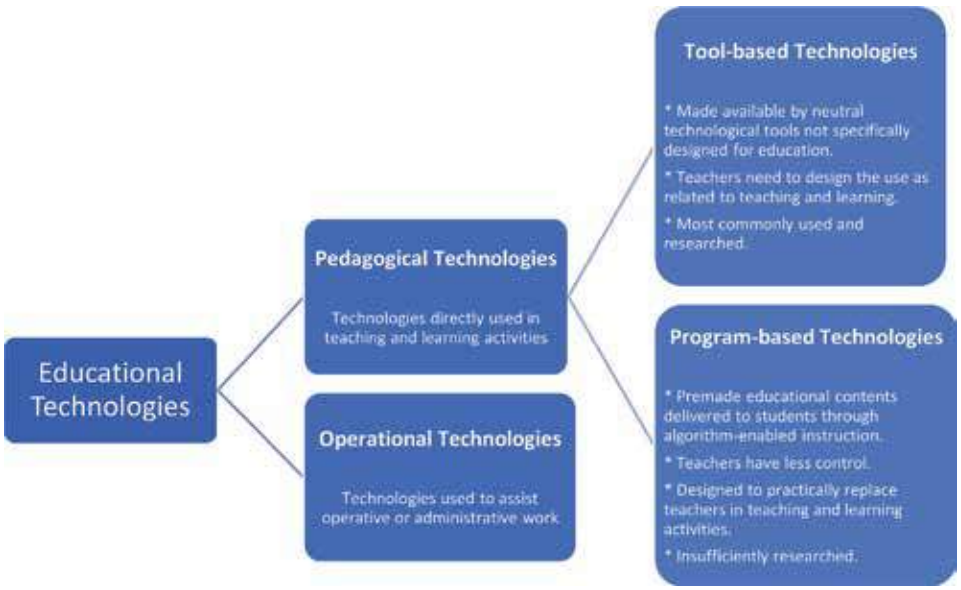

Figure 2.
Categorization of educational technologies.

for educational purposes, they represent an integration of traditional technological tools to assist teachers instead of being designed to replace teachers' pedagogical functionalities (**Figure 2**).

3. Adoption of tool-based technologies

Most studies on teachers' use of technology refer to the use of tool-based technologies. Teachers' successful adoption of this kind of technology, for themselves to either motivate students or deliver instructions more efficiently or for students to engage in learning activities using technology, depends on three crucial factors: professional support, teachers' attitude, and learning goals.

The use of tool-based technologies in educational settings highly depends on teachers' competency to innovate and design. A misconception is that the introduction of technological tools to schools is equivalent to the introduction of educational technologies. On the contrary, teachers tend not to innovate when technologies are provided [6]. Teachers need to develop knowledge and skills to employ technological tools for educational purposes. Therefore, adequate professional support is needed, so teachers will be able to master the effective use of technologies specifically within a classroom setting. Teachers who have received professional development are more proficient in using technologies and are more likely to use them, whereas without professional development, teachers are not only less proficient but also likely to resist integration of technologies [4, 7]. Unfortunately, educational technology training is lacking in teacher preparation programs in universities [8]. Thereafter, in the teaching field, the majority of teachers only receive <8 h of professional development on educational technology annually [9].

A successful professional development program needs to pay attention to both its content and its format. It should contain content knowledge in three areas [10]:

1. Knowledge about technological tools: technical knowledge that helps teachers to become equipped with skills to use hardware and software

2. Technology-supported pedagogical knowledge: specific knowledge and skills that teachers need to learn that help them to use technology to design materials, deliver instructions, or engage students to achieve the learning goals in specific academic domains

3. Knowledge about technology-related classroom management: knowledge giving teachers insight into students' reaction in a tech-infused learning environment, for example, how to prevent students from using the devices and the Internet to do inappropriate activities in disguise.

The effectiveness of such a program is closely tied to a school's ability to develop a supportive learning community [7, 11, 12]. Professional development programs on educational technologies work less efficiently when they are only content- and knowledge-based; communication and interaction are of high significance [10]. A successful professional development program should be a place where:

1. Teachers can discuss their tangible and immediate needs related to the use of technologies [7, 13].

2. Teachers can share successful examples of the use of technologies in real educational settings [14, 15].

3. Teachers can have opportunities to work with knowledgeable peers [11].

4. Teachers have adequate time to explore the technologies on their own [4, 16].

Learning with real examples in the field created by peers has been proven to be essential in professional development. This is also true of teacher preparation programs. Preservice teachers who have real in-school experience learning about technologies in real educational practices are more likely to succeed [8, 14, 15, 17, 18]. To leverage the power of tool-based technologies in teaching and learning, educational technology training should be very content-specific—for example, how to use the visual features of *PowerPoints* to demonstrate abstract geometry concepts in math classes and how to guide students to make an online survey in social studies. It is crucial that teachers do not receive vague information in professional development but rather have opportunities to discuss and learn specific techniques to assist immediate pedagogical needs with peers.

Teachers' attitude toward the effectiveness of technology affects the adoption of tool-based technologies as well. Such effects can be played out on both personal and interpersonal levels. Teachers who individually believe technologies will help them conduct better education are more likely to succeed at using them [15, 16, 19, 20]. Many of these teachers believe that technologies can help to better engage students, introduce project-based learning, help students access more information, and enhance communication and collaborative learning [21–23]. However, it is common for teachers to hold negative impressions toward the use of certain technologies, which makes it harder for them to integrate those technologies [19, 24, 25]. This situation often happens when teachers are not given sufficient information and training to learn the specific benefits of technologies, which leads them to worry about risking educational resources and teaching time to integrate unnecessary or potentially detrimental technologies [26, 27]. Additional common negative attitudes among teachers include fear of losing control over technologies, technological misfunction and lack of IT support, and concerns about the lack of time to adjust to new pedagogical practices, risking student test scores [26–28].

On the interpersonal level, experienced teachers' attitude toward technology significantly influences young professionals' impressions about technology. When experienced teachers exhibit a more positive and welcoming attitude toward technology, that often translates into a school culture that embraces technology and encourages teachers to support one another in terms of developing and designing learning programs that take specific advantage of technology [24, 25]. Moreover, a positive attitude among teachers also translates into positive attitudes toward education among students and better learning engagement [29].

Research also shows that teachers who believe technologies can help them transform from lecture-based learning to student-centered learning are more likely to welcome technologies [21, 23]. Therefore, the foundation provided by a school's learning goals, often reflected in institutional policy as well as practice, also significantly affects teachers' adoption of technologies [7, 16, 30]. Teachers tend to avoid technologies if they believe technologies, even if helpful, deviate from the school's learning goals [31]. For example, teachers may believe certain technologies can help students to do collaborative projects, but given the limited time and pressure from standardized testing, teachers may choose to teach to tests instead of integrating the technologies for new learning tasks.

Our current education model was largely invented for and defined by the Industrial Revolution, designed to meet the need of massive labor demand with standardized skill sets [32]. The advantage of technology has been restricted by the nature of our traditional education paradigm, where teaching and learning occur in a mechanical way with learning goals aimed at the mastery of knowledge. This learning goal can be very often achieved by traditional pedagogical techniques that do not require technological integration, such as direct instruction. Therefore, teachers often do not see the need to use technologies to conduct education in an efficient way to help students to achieve learning outcomes set by graduation standards and measured by standardized testing [1]. On the other hand, teachers are likely to have a positive impression of technology if they believe in constructivist learning [33, 34]. From a constructivist perspective, technology can serve as a powerful tool for both teachers and students to conduct research, assist in self-directed learning, and design and produce media-infused projects. Indeed, teachers tend to increase the use of technology if the learning goals are set up to be student-centered and project-based, focused on high-level skills such as creativity, research, and critical thinking [7, 21].

3.1 A need to redefine learning goals

Fundamentally, technologies should be offered as a way to achieve schools' learning goals, and the question we should ask is: What can we do now with technology that was not possible before? [1]. However, very often, we do not have an identified problem in education that we hope technologies can help us solve, and we do not have a clear goal or expectation about how technology should be positioned in education to help with our learning goals [35]. We realize that technologies are something good to have, and it seems irresponsible if we fail to harness this power for education. Therefore, we have introduced technologies into schools, without changing any of our traditional practices, in an effort to enact their great potential. Instead, what we have largely done is carve out some tiny spaces for technology to fit into the traditional learning paradigm. If we go into a classroom, we will find out that the most popular technologies in schools are projectors, document cameras, and smartboards. Those technologies are helpful, but not necessary; the functions they perform could be done adequately before we had technology. Teachers who see technologies merely as supplemental tools for instruction are less likely to

successfully adopt them [7]. Technology in today's school setting gives teachers a third hand. It is something good to have, as it allows teachers to accomplish some tasks in a more convenient and efficient way [36]. However, its existence only brings quantitative difference without qualitative difference to the advancement of pedagogical practices [35]. Teachers who are experienced in teaching without technologies often do not see the necessity of having them [24, 25, 30]. Therefore, a true, successful adoption of tool-based technologies in education should start at the institutional level by redefining the learning goals that cannot be accomplished without technologies. For example, if our learning goals go beyond mastering of testable knowledge that can be obtained through direct instruction to creative and collaborative skills in project-based learning, we would arrange our class in such a way that students, under teachers' guidance, could conduct research on the Internet and produce digital media such as videos and *PowerPoint* presentations.

Tool-based technologies are only as good as the way in which they are used by teachers. These technologies are not educational in nature but rather require teachers, through design and proper implementation, to transform technological tools into tool-based technologies that enhance teaching and learning. In the case of tool-based technologies, this adoption process is more important than the technologies themselves. Therefore, teachers are the key instead of machines, and teachers need to have the incentive and adequate skills to realize the process. Unfortunately, schools tend to spend tremendous resources to purchase and maintain equipment but often neglect to invest in helping teachers to adopt them [37]. The adoption process starts with redefining learning goals. Learning goals that demand less mechanical learning of content knowledge and value high-level skills—aligned with student-centered, constructivist learning and creative instruction—motivate teachers to see the unique value of technologies and develop a positive attitude toward their use. Suitable learning goals set direction for professional development for both preservice teachers in universities and in-service teachers in the field. Positive attitudes create a solid foundation for a collaborative learning community to take place, which helps teachers to be equipped with sufficient content knowledge and

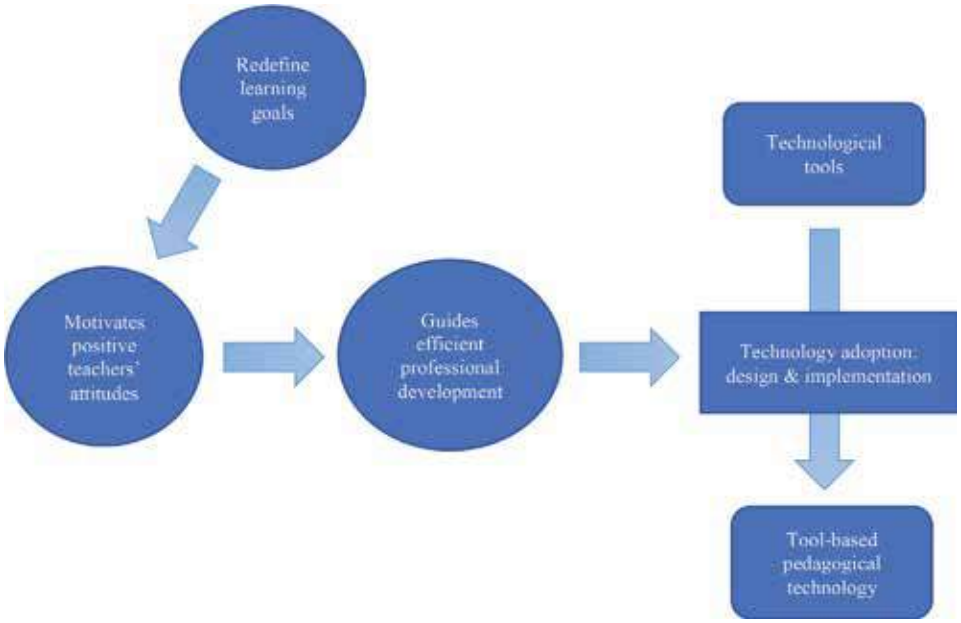

Figure 3.
Teachers' adoption of tool-based educational technologies.

skills for adopting technologies to assist pedagogical practices. An efficient and thorough change starts with redefining learning goals, which are hopefully initiated top-down. The role of school leaders and experienced teachers is of the utmost importance (**Figure 3**).

4. Double-faced program-based technologies

With recent advances in technology, we have entered the Information Era, especially after the invention of the Internet. Technology made digitalized content become the main resource from which we gain information and knowledge [38]. If we think of learning as a broad, lifelong process, most knowledge we learn today is not in classrooms. With technology, we expand the learning environment, which means that learning is no longer restricted to formal classroom instruction. Some believe that if we focus solely on the work of passing information and knowledge, technology is probably able to replace some components of traditional teaching. Others predict that mobile learning will partially take the place of teachers [39]. Mobile learning has several advantages. First, technology makes information and knowledge more accessible, and students can access more enriched resources of information through mobile learning. Second, learning environments can be expanded, and as long as students can access technology, they can learn anything, anytime, and anywhere. Third, mobile learning allows students to customize learning [40]. Among all the expected benefits, personalization of education has stirred up the most hope—traditionally, dozens of students receive the same information from one teacher in a classroom. However, with technology, every student has the opportunity to learn topics that have been individually tailored. Using technologies to fulfill personalized education has recently attracted tremendous attention from Silicon Valley, fueled with hundreds of millions of dollars from the Chan Zuckerberg Initiative [5, 41]. A program developed out of this initiative is called Summit Learning, which has been collaborating with hundreds of US schools to implement its personalized learning programs. These programs deliver individualized learning content of core academic subjects of grades 4–12, from a computer to a student, with the hope that students will study better with technologies than teachers [5]. These personalized learning programs are given to individual students based on an analysis of their learning attributes using an artificial intelligence algorithm. In such programs, technologies and learning contents included have been predeveloped by technology companies that give teachers little autonomy over the balance of teaching between teachers and machines. Also, many aspects of how the algorithm works often reside in a black box, remaining largely unknown to teachers or researchers. Learning through these technological programs, or, in other words, program-based technologies, is a fundamentally different pedagogical practice and learning experience than the use of tool-based technologies, which are still largely driven by teachers. However, program-based technologies are primarily driven by digital programs.

4.1 The promise of program-based technologies

Although in the technology industry such distinction has been seldom made, the field of educational research has classified personalized education into two categories: outcome personalization and process personalization [42]. Outcome personalization gives students autonomy in the learning process. Many student-centered, project-based learning programs are designed in such a way that students may design a project of their choice, while the education process helps students

to master necessary skills and knowledge to achieve the project. Outcome personalization is often filled by tool-based technologies, which give both teachers and students more creative power. However, most program-based technologies are used to fulfill process personalization, which gives students little choice over the learning process. Students are merely given customized learning materials selected based on computer algorithms, and the end goal of the process is to help students achieve standardized learning goals. In essence, program-based technologies could sufficiently fit into the demand of the traditional educational paradigm that emphasizes mastering standardized knowledge and skills. If implemented well, program-based technologies are expected to replace a considerable portion of teachers' functionality.

Advocates for the use of program-based technologies in personalized education believe that technologies can do a better job than traditional teachers because these technologies can unremittingly monitor individual students' learning progress and simultaneously provide learning contents that are most suitable to individual students' habits and learning attributes [43]. With a highly sophisticated algorithm, big data, and a large pool of well-tailored contents, technologies are expected to have certain advantages over human teachers in terms of delivering more effective instruction to each student. Additionally, advocates believe that technologies are more economically efficient and more accessible than human teachers, which can help to scale up good education and improve equity and equalization in education [40, 43]. Finally, teachers could be liberated from the mechanical work of teaching students basic knowledge and skills so they could be more focused on helping students with additional higher-level learning.

4.2 The problems of program-based technologies

Before using artificial intelligence for personalized learning, program-based technologies were largely made of learning games, with the hope that learning could be delivered in an attractive format. However, the downfall came when it became more and more clear that most educational games were not as attractive to students as regular computer games, and students easily lost interest over time [44, 45]. As a consequence, the interest in learning games has been gradually disappearing in the industry. Unfortunately, personalized learning technologies seem to share the fate of learning games—not only the fate of failure but also the specific inability to engage and motivate students in the learning process.

Very little research has been conducted on the effectiveness of Summit Learning's personalized learning technologies; nor has there been much research on other program-based technologies on personalized learning [45]. Besides questionable learning outcomes, these technologies face tremendous challenges due to students' negative reaction toward the learning experience under such programs. A study shows that students significantly feel less engaged in and experience less enjoyment in school due to lack of human interaction [46, 47]. Also, there have been news reports showing that personalized learning technologies face backlash among students and parents. Some students claim they feel they were like zombies sitting in front of computers all day long [41]. The intangible "joy" of learning, so often derived from human discussion and interaction, seems to be compromised by such programs. Overall, concerns about these technologies are as follows: they reduce students' reported joy of learning; jeopardize students' bond with teachers, while a healthy relationship between children and adults is essential in their development; isolate students; encourage unhealthy competition by exposing the difference in students' learning progress; and are prone to misuse of student data by big corporations [48]. With all these perceived negative images in the public

arena, it is not hard to assert that current efforts of using program-based technologies to conduct personalized education to replace teachers, represented by Summit Learning, will be far from successful. However, there is not much rigorous evaluation of such programs through imperial research, nor does it seem that the developers of these programs have any immediate intention to grant access to scholars to conduct any evaluation.

4.3 A need for research on program-based technologies

Given that program-based technologies in education are largely developed by the technology industry instead of educators or educational researchers, as well as a special commercial interest in the industry, those technologies have seldom been well-examined in an empirical way, nor have their developers been given the incentive to conduct considerable research or comprehensive program evaluation. Chan Zuckerberg's Initiative originally planned to work with the Harvard Graduate School of Education to examine the effectiveness of its Summit Learning Program, but it was called off by the initiative before the research started [41]. By the time this paper was written, we still did not know, despite students' negative emotional reaction toward the program, whether the program could deliver its academic promises. Many factors may determine the success of program-based technologies, such as the content of learning materials, the artificial intelligence or other algorithms to assess students' learning progress, and the implementation in school settings in relation to teachers' assistance and other school activities. Many of the promises of technology-enabled personalized learning do not lose their attraction because of the failure of a first attempt. Future research is urgently needed to comprehensively examine these new technologies.

The significance and advantage of human teachers cannot be easily replaced. Although knowledge can be easily accessed through program-based technologies, a lack of human interaction and motivation results in reduced knowledge acquisition among students. As learning is not a mechanical cognitive activity, students' negative emotions could lead to *not learning*, which does not refer to being incapable of learning but a term describing the psychological state of resistance to participation in learning activities [49]. It is highly possible that program-based technologies could never work alone. They might need to open space to work closely with human teachers to be effective. Unlike tool-based technologies, which have been thoroughly researched, the adoption of program-based technologies has seldom been studied. Many do not even see the distinction between those two groups. We urge the industry and the scientific community to conduct more research on program-based technologies, which will surely open a new frontier in our understanding of the use of educational technologies in pedagogical practices, as what it takes to adopt teacher-driven tool-based technologies could be vastly different from newly emerged algorithm-driven program-based technologies. We suggest not only to research the technologies themselves, including their learning contents and algorithm, but also how these technologies are positioned in the ecological system in school and how human interaction can work together with the algorithm.

5. Conclusion and a look into the future

It has been a long-held misconception that educational technologies are homogeneous and they behave in a similar way in relation to teachers' adoption and school implementation, among other factors. It is an oversight in the field of educational

research that we have seldom made any distinction in the kinds of technologies that have been used in schooling, instead often studying them in a singular set. This was not an influential mistake when most technologies used in pedagogical practices were tool-based technologies and indeed shared many similarities. However, with the recent introduction of artificial intelligence into personalized education, new categories of technologies have emerged that are drastically distinct from the ones before. Therefore, a careful categorization of educational technologies should be made to help us study issues on educational technology in a well-structured way. Educational technologies are composed of pedagogical technologies (used in direct participation of teaching and learning activities) and operational technologies (used in the operative and administrative work of teachers).

Pedagogical technologies can be further split into two groups: tool-based technologies and program-based technologies. Tool-based technologies are the most common, have a longer history, and have been well-researched. They refer to technologies that are not specifically designed for educational purposes and are versatile tools in nature. Teachers' adoption of these technologies through a process of design and implementation transforms these technological tools into pedagogical technologies that assist in teaching and learning. Teachers are less inclined to use tool-based technologies if they are considered supplemental instructional tools for efficient lectures. On the other hand, teachers are more likely to use such technologies for student-centered constructivism learning because of technologies' power to hone creative and critical thinking skills. Therefore, efficient adoption needs to be top-down, starting by setting learning goals that demand high-level creative skills instead of the mechanical acquisition of content knowledge. Suitable learning goals motivate teachers to see the value of developing positive attitudes toward technologies, which should fuel professional development programs, which should not only deliver adequate content knowledge but also create supportive and collaborative learning communities among preservice and in-service teachers. As such, teachers could be equipped with the skills, knowledge, and emotional drive to adopt tool-based technologies.

Program-based technologies are predeveloped with learning contents that are delivered to students in a preprogrammed way. They leave less control to teachers and instead drive learning by their own artificial intelligence or other program algorithms. Although there has been high hope that they could replace teachers' instruction to provide students with a personalized learning experience, the lack of human interaction often makes students feel less engaged in schooling and results in learning resistance. More research should be conducted in this field to study these technologies and the possibility of teachers working with algorithms in a more collaborative way instead of a either teacher or computer modal.

Technologies bring the Information Era to schools. As the economy has shifted from labor-demanding to innovation-demanding, learning of basic skills and content knowledge is far from enough. A new competence set of creativity, collaborative learning, and research is more valuable than ever, which translates into new learning goals that demand students to be innovative and proactive learners. Technologies can help with that, but, without question, the role of teachers is still critical. Technologies cannot exclude teachers but should rather work with teachers to transform education from instruction-centered to student-centered. Tool-based technologies give teachers the means to be innovative and achieve that goal. Program-based technologies should be developed in a way that work seamlessly with teachers through research-based practices, instead of repeating the failure of pursuing student-centered learning by replacing teachers. After all, information can be digitalized, but learning itself is still a very human business.

Author details

Perry P. Gao[1*], Arvid Nagel[2] and Horst Biedermann[2]

1 Harvard Graduate School of Education, Education Bridge Institute, Cambridge, USA

2 St. Gallen University of Teacher Education, St. Gallen, Switzerland

*Address all correspondence to: perry_gao@mail.harvard.edu

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Section 4

Educational Partnerships

Chapter 11

School-University Partnership for Evidence-Driven School Improvement in Estonia

Kätlin Vanari, Kairit Tammets and Eve Eisenschmidt

Abstract

It has been acknowledged that evidence-driven practices may lead schools to improved instructional practices, student learning, or organizational improvement; still the evidence is underused by the teachers or school leaders. This study focuses on analyzing how to strengthen the evidence-driven school improvement in school-university partnership programs. Five schools learnt over a period of one school year in collaboration with the university coaches how to collect evidence in classroom and organizational level for improvement process. The results of our study illustrate profiles of the schools based on the usage of data-informed evidence, research-based evidence, or both to make decisions in the instructional and organizational level. Enablers and barriers of data use from the perspective of organizational, user, and data characteristics to implement evidence-driven practices are discussed.

Keywords: data-informed evidence, research-based evidence, evidence-driven school improvement, school-university partnership

1. Introduction

The Estonian Lifelong Learning Strategy 2020 [1] aims to implement a learning and teaching approach that supports each learner's individual and social development, learning skills, creativity, and entrepreneurship in the work of all levels and types of education. To achieve this demanding goal, new teaching practices should be developed in collaboration between universities and schools. This also means that every school should focus on their students' individual needs—instead of implementing already existing approaches, new solutions should be created or modified to fit into local context. When adapting new teaching and learning methods, important questions arise: what is the impact of these approaches and what other factors are influencing the outcomes.

In this new situation, schools continuously develop their practices, analyze the needs of teachers', and find ways for their professional development. Hansen and Wasson [2] have pointed out that there is a need to change teachers' professional development format—instead of traditional participation in training courses, teachers should be supported in developing and improving their existing practice through teacher inquiry. Nowadays, capacity building, inquiry-oriented practice, and data-driven decisions are considered as central themes of educational

improvement [3, 4]. Concepts like practitioner research and teacher inquiry have been widely used for several decades—yet schools still face difficulties in using evidence for school improvement processes [1].

In the age of big data, it is difficult to imagine any educational improvement that does not include data as a key pillar [6]. Developing evidence-driven school improvement processes through school-university collaboration is one option for helping schools work with evidence. Therefore, school-university joint programs are initiated and the Future School Program was launched in Estonia. The aim of the Future School Program is to support whole-school innovation and sustainable improvement of teaching practices by enhancing the teaching and learning culture through school-university co-creation of new methodologies and implementation of evidence-driven innovation.

In this chapter, we analyze how to strengthen the evidence-driven school improvement in school-university partnership program. Following questions are discussed:

- How evidence-driven school improvement is actualized in school development programs?
- What are the enablers and barriers of using evidences in school development program?

2. Evidence-driven school improvement: theoretical underpinnings

Nowadays, educational innovation is not only the "business" of scholars—practitioners are actively involved and discussions about educational improvements revolve around the importance of evidence and data. Different authors use distinct terminology [7] evidence-informed education [8], evidence-informed practices [9], evidence-based practice [10], evidence-based education [11, 12], data-based decision-making [13, 14], data-informed practice [15], data-driven decision-making [16, 17], data-based decision-making [18], data use [7, 19–21] and practice-informed evidence [22]. The main idea behind these concepts seems to be concurrent; however, the use of different terms is not incidental. One of the broadest explanation has been given by Davies [23], who sees evidence-based education as a set of principles and practices, which can alter the way people think about education, the way they go about educational policy and practice, and the basis upon which they make professional judgments and deploy their expertise—but it is not the provider of readymade solutions to the demands of modern education. In the following sections, we compare and analyze how different concepts supplement each other and how the evidence-based improvement can be identified for the schools.

To start with, we need to unravel the concepts of evidence as they are widely used. Evidence is a kind of information, which points to the truth or validity of a claim and is the joint starting point for all authors; opinions differ on how truth or validity is achieved. It is assumed that the main source of evidence practitioners should consider when making decisions in social science research, namely experimental research and randomized controlled trials [10, 11, 24]. The idea that research can make a major contribution to improving practice stems from the assumption that it is systematic and rigorous and provides explicit evidence, which can be assessed objectively [10]. It can be concluded that one sub-concept of evidence-based education concentrates on implementation of research results, especially implementation of these teaching techniques and methods, which have

been found to have a positive effect on students' assessment results. In the following, we distinguish this sub-concept as a research-based school development.

Research-based evidence as a source for school development and teachers' professional development has been criticized from different aspects. The disapproval of research-based evidence has been argued with the nature of research, its generalizability, and objectivity. It is recognized that professional judgments cannot be made without taking into consideration the value-based foundation of education [11]. However, research findings merely inform practitioners about what the general outcomes are of different kinds of decisions [24], and there are a variety of formal and informal sources of information that also contribute to the decision-making process [10, 24]. Schools and teachers cannot wait until the valid and reliable research results say how to implement new teaching practices.

Evidence-based education operates at two levels. First is to utilize existing evidence from worldwide research and literature on education and associated subjects [23]. This gives a broader base for professional knowledge-in action [15]. The second level is to establish sound evidence where existing evidence is lacking or of questionable, uncertain, or weak in nature [23]. It requires acquiring, using, critiquing, and creating the evidence base by the lived experience of observing and assessing students in particular contexts on a regular basis [15]. This type of professional knowledge relies on multiple values, tacit judgment, local knowledge, and skill; research usually cannot supply what the notion of evidence-based practice demands of it—specific and highly reliable answers to questions about what works and what does not [10]. In this case, the basis for innovating instruction is the data what the context offers. The data about the students, their background, their previous achievements, as well as teaching processes, and school organizational existence is wide and the potential of this data is unused.

The definition of data is broad. The focus is on raw data that must be organized, filtered, and analyzed to become information, then combined with stakeholder understanding and expertise to become actionable knowledge. The data not only enclose student test results, but also any other form of structurally collected qualitative or quantitative data on the functioning of the school, such as outcomes, inputs, processes, and perceptions [13, 25]. In short, data are the information that is collected and represent some aspect of schools [26]. If the evidence incorporates the question and the answer, the data comprehend only the question and the potential of the answer. The evidence incorporates the interpretive and evaluative elements, which are missing from the data. In conclusion, we distinguish the second sub-concept of evidence-driven school improvement as a data informed.

In addition to the data-informed and research-based dimensions of evidence, the distinction of the outcomes can be identified [7]. The expected outcomes of the evidence usage describe the goals for which the evidence is used, more specifically, the aspect of the school culture which is expected to be improved and changed according to the conclusions made from the evidence.

Discussions of evidence-based or evidence-informed practice refer to teachers, their classroom activities, and interactions with students [7, 9]. The data and evidence use are implemented with the goal of improving instruction. The quality of teachers' instruction is an important influence on student achievement, and using data for improving instruction can enhance student achievement [13].

Data and evidence can also be used to inform decision-making in school management and leadership levels. This process is often called data-based or data-driven decision-making [13, 16]. Data-driven decision-making is the purposeful process of selecting, gathering, and analyzing relevant data to define school problems, develop alternatives, estimate outcomes of the alternatives, and choose the preferred alternative [16]. Data do not objectively guide decisions on their own—but people do. To

do so, they select particular pieces of data to negotiate arguments about the nature of problems as well as the potential solutions [14]. The use of data is not only a matter of new competencies and skills, it is more about the new culture to arise. Good things do not happen thanks to data—it should be supported by data-informed leaders. Leaders should take the responsibility to evaluate what types of data are useful and for what purposes [17]. Organizational practices have an important role in affecting the way that people in organizations think and work, so it is possible to shift patterns of practice by creating organizational supports and incentives that give greater prominence to the consideration of research findings and their implications [8]. In such a case, the data and evidence can be used for school development purposes and it refers to schools using data to improve themselves; for instance, student satisfaction surveys and exam results can be used to evaluate the extent to which the school is achieving its goals [13]. The processes of decision-making and interpretation happen in parallel; this way, there is potentially a higher coherence among the data, the decision, contextual factors, as well as the risk of misinterpretation or biased interpretation.

In conclusion, we have identified two dimensions of the concept of evidence-driven school improvement (**Figure 1**). One of the dimensions is the input dimension, which refers to different inputs of the evidence: the evidence can be data informed or research based. The data-informed evidence can appear from assessment results, characteristics of teaching staff, national or school surveys, etc. The research-based evidence can be the result of some experimental study or qualitative study on teachers' behavioral patterns. The second dimension characterizes the output of evidence: whether the evidence is influencing decisions made for school development, incorporating the organizational aspects like the structures, communication, or decisions made for the improvement of instruction by the teacher, usually in the interaction with the student and used educational method.

Studies of data use have analyzed the factors influencing evidence-driven school improvement, and based on the synthesis of recent studies [13], it can be concluded that these factors are organizational characteristics, user characteristics, and data

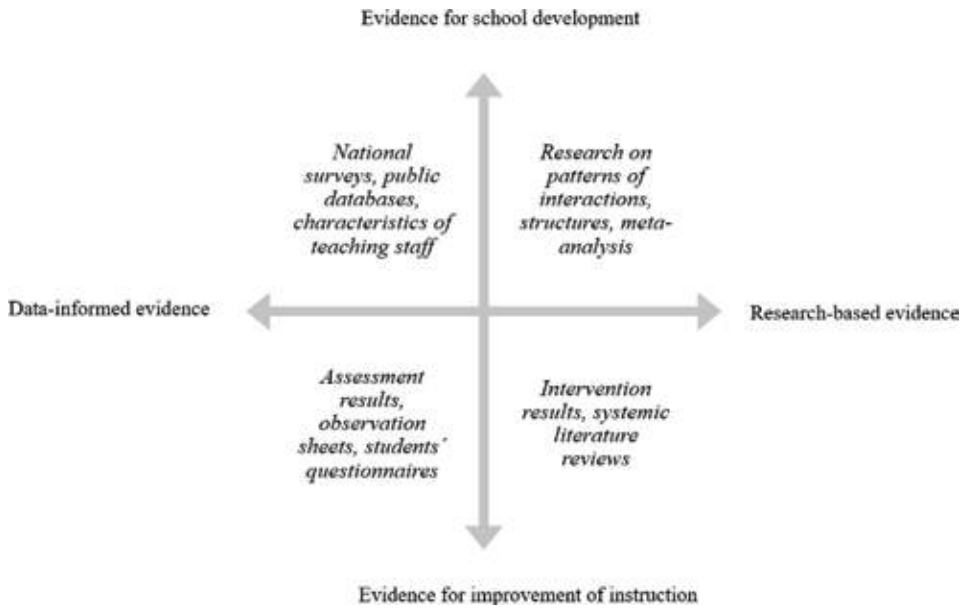

Figure 1.
Dimensions of evidence-driven school improvement and some examples.

characteristics. Organizational factors include the shared vision and clear norms for data usage, encouragement by the school leader, possible expert support, time, and conditions provided for collaboration between teachers. Data use depends on the user characteristics of teachers. In order to use data, teachers need to have the knowledge and skills needed to analyze and interpret different forms of data; they need to understand the quality criteria for data use and data-use concepts; and they need skills to diagnose student-learning needs and adjust instruction accordingly. Data characteristics are identified as access to student relevant data, and the usability and high quality of data. It is important to note that these factors can be enablers or barriers depending on the goal of the data use. The study [13] shows that data use for school development is influenced by organizational and data characteristics, but data use for improving teaching and learning is influenced by organizational and user characteristics.

Additionally, the evidence-driven school improvement implemented in school-university partnerships is influenced by the character of the relationship. The partnership can be as two types of relationships between schools and universities: one type of partnership can be labeled as transactional and refers to a relationship, which is driven by individual purposes—in this case, the organizations remain unchanged; the second type is transformational partnership, where the parties come together to pursue a common purpose and create the possibility of growth and change through mutual interaction as they apply their resources to address complex problems [27]. Studies [7, 17, 25, 28] investigating strategies of school-university partnerships for supporting evidence-driven school improvement have identified four key domains: (1) human support, (2) leadership, (3) technology support, and (4) designed routes.

One possibility to offer human support is to use coaches. In order for coaching on data use to be effective, teachers needed to believe that the coach possesses strong interpersonal skills, content, and pedagogical knowledge that would be useful for them to learn. Facilitation of coaches includes assessing teachers' needs, modeling how to interpret and act upon data, and observing teachers while they attempt to engage in the data-use process. Another possibility is to support professional development, but from previous studies, it is evident that the structured training in how to use data is not common in schools. A third approach to human support is networking with a university: either the researcher guides the process of data analysis and brings a theoretical framework to the practice or relies primarily on workshops and ongoing consultancy.

Schools make efforts to have technology support: data systems that organize and analyze interim assessment data, and data warehouses with current and historical student data. It is acknowledged that the trainings for school teams on data use are rare and focus primarily on technological support and how to access the data management system. Technological support needs to be combined with other strategies.

School leadership—principals are key players in facilitating data use among teachers, they play an important role in allocating resources and time to enable teachers to use data effectively. Their espoused beliefs about data use are critical as well, so they help set the tone for data use among in school teams. For the school leader, it is important to have a whole school perspective on the improvement initiated. If the instructional and organizational improvements are not aligned, it is confusing and unmotivating for the teachers to participate. It is important to communicate for the teachers why the evidence is being collected in classroom level and how it helps to monitor the big picture of the improvement and data are not used to blame-and-shame teachers. The evidence-driven school improvement cannot be implemented without data-literate and research-wise school leader, so the crucial target to support strategies is the leaders in schools.

Schools are required to follow norms and designed routes—specific data-driven decision-making practices—when developing their school improvement plans or for teachers to follow when using data to guide instruction. One of the primary ways that is used to build teachers' capacity to use data is providing structured time for collaboration. This includes adoption of data-discussion protocols in order to ensure that discussions about data occurred and that actions were taken on the basis of these conversations.

Factors that influence the successful implementation of a school development program with the aim to support evidence-driven school improvement have been studied. Schools are more successful, if the entire school team participates in the program, the school staff is stable and the school leader provides their teachers with sufficient time and materials. It is concluded that school leaders and trainers should pay attention to developing clear guidelines and agreements on the execution of evidence-driven school improvement activities [18].

3. Methodology

3.1 Context: overview of the school improvement program

The research context is formed around the school improvement program established at the Tallinn University. The program aims to support the evidence-driven improvement in Estonian schools for improving teaching and learning culture. Five schools applied (**Table 1**), based on their interest, to join the program in 2018/2019. Each school team consisted of 5–6 members, whereas 1–2 of them where members of the management and each school formulated their own student-centered goal for the improvement they aimed to achieve.

3.1.1 Evidence-driven improvement process

In the first phase of the program, each school prepared an action plan for improvement. Before creating the action plan, an analysis of the state of the school, built on existing evidence, had to be carried out. Some of the schools used data collected at the national level (satisfaction surveys, students' study results, and existing research studies) to understand the current situation, defining the problem,

	School size	School type	Improvement goal
S1	Teachers: 111 Students: 811	Public kindergarten-basic school	Teachers' collaboration implementing collaboration-days
S2	Teachers: 68 Students: 769	Public secondary school (up to 12 grade)	development of students' learning to learn skills
S3	Teachers: 19 Students: 169	Public basic school (up to 9 grade)	students' motivation to learn through systematic integration of the lessons and outside of the classroom activities
S4	Teachers: 60 Students: 519	Public secondary school (up to 12 grade)	students' engagement in extracurricular activities
S5	Teachers: 19 Students: 155	Public basic school (up to 9 grade)	integrating real-life situations to classroom activities in 7th grade

Table 1.
Characteristics of schools participating in the school improvement program.

and formulating the action plan. When analyzing the evidence, three school teams changed their initial goals because they did not find clear evidence about the problem they thought the school had or they identified another problem based on the evidence. During program activities, schools had to monitor and reflect on their own activities to understand their improvement processes. Each team agreed upon their own approach and tools for monitoring and data collection, which were discussed with their university coach. In addition to the regular monitoring, each school had to design their own action research plan, carry out the study in a classroom setting, analyze the collected data, and come up with suggestions on how the data will be used in the next decision-making steps.

3.1.2 School-university partnership

The program consisted of elements of human support, support for leadership, and designed joint activities. The school team—where the school leader was a compulsory member—participated in monthly seminars, where the next steps of the program were explained through theoretical underpinnings and practical suggestions. The seminars were used in the program, because the studies have shown that supporting professional development is essential in raising data-literacy skills of educational practitioners [25]. The networking aspect of the seminars is also effective to support for schools. Between seminars, the school team was supported by their university assigned coach. The coach is recognized as one of the key elements in offering human support [25]. Each step was scaffolded with the special task designed according to principles of change management and evidence-driven improvement. Data use can be improved by data-use routines, ensuring that it is a recurrent and patterned interaction that guides how people engage with each other and data [7].

3.2 Data collection and analysis

We followed the case-study approach, which has been acknowledged as an appropriate method in educational studies about evidence use [28]. Case studies do not aim to produce generalizable theories, but aim to provide practical wisdom, which is "about understanding and behavior in specific situations" [29]. That was also the aim of our study—to better understand the collaborative practices supporting schools in implementing evidence-driven school improvement.

Data were collected throughout the program and after the completion of the program. A variety of data gathering techniques that are summarized in **Table 2** were used.

Data were analyzed based on the framework from theoretical underpinnings, where different dimensions of evidence use for school improvement were defined (**Table 3**). Instructional-level decision-making refers to the teachers' decisions to improve their own teaching, assessment, feedback, etc. Organizational-level decisions refer to the decisions made by school management or school improvement team to improve school-level processes, practices, curriculum design, etc.

Evidence-driven practices of the five cases were classified according to nine possible profiles of evidence-driven school improvement. These profiles were created according to criteria defined from the dimensions of evidence-driven school improvement. The criteria were the following:

- Whether the school collected (a) data-informed evidence, (b) research-based evidence, or (c) both. We classified the school as using data-informed evidence when the data were collected by the school or made available for

Instrument	Goal	Sampling
Interviews with the teachers and principals	Semi-structured, face-to-face focus group interviews with the teachers and individual interviews with the principals to understand the co-creation practices and challenges faced.	5 school principals 14 teachers from 5 schools
Monthly reflections by the school teams	Google form questionnaire consisting of 8 questions, but 4 relevant for this study to identify the co-creation practices.	5 teams from 5 schools, altogether 36 posts
Documents created by the school	Materials created by the schools as part of their inquiry activities (action research results and data collection instruments)	5 school reports, presentation

Table 2.
Overview of data collection.

Cases	**Instructional level decision making**	**Instructional and organisational level decision making**	**Organisational level decision making**
Data-informed evidence	Data-informed decision making in instructional level	Data-informed decision making in instructional and organisational level	Data-informed decision making in organisational level
Data informed and research-based evidences	Data-informed and research-based decision making in instructional level	Data-informed and research-based decision making in instructional and organisational level	Data-informed and research-based decision making in organisational level
Research-based evidence	Research-based decision making in instructional level	Research-based decision making in instructional and organisational level	Research-based decision making in organisational level

Table 3.
Profiles of the cases based on dimensions of evidence-driven school improvement.

the schools by other stakeholders, and analysis was done by the school team based on their own research and improvement interest. We classified the school as using research-based evidence when the data have been collected, analyzed, and published by researchers, and the results are used by schools in their improvement process.

- Whether the school analyzed the results with the goal (a) to improve school management, (b) to improve instruction in the classroom, or (c) both. The school was classified to use evidence on management level when the school team made decisions about communication, professional development, work organization, procedures, etc. We classified the evidence as used for the instructional improvement if the conclusions and recommendations were targeted toward teachers and their activities.

4. Results

Evidence-driven practices as part of the school improvement were tightly embedded into the different phases of program activities. Next, the schools' practices to actualize the evidence-driven school improvement, the challenges, and enablers of the process will be analyzed and discussed. The aim was to understand the following: to what extent schools used evidence collected from wider research,

whether they collected or analyzed data based on their own research interests, and was the results used in organizational-level or instructional(teacher-student)-level decision-making processes.

Based on teams' reflections, interviews and analysis of the documents schools were profiled as follows (**Table 4**): usage of data-informed evidence, research-based evidence, or both to make decisions in the instructional level or organizational level or both.

4.1 Data-informed decision-making in organizational level

The aim for school 1 was to improve the teachers' collaboration and through that improve the students' learning experience, for that a new initiative was established as "collaboration day." Based on the reflections and document analysis, the school team focused mainly on collecting data from teachers and students to understand the usability and effectiveness of the collaboration format—questionnaire for the teachers and students after each collaboration day, students' self-analysis, and observation sheets. Evidence regarding well-established methods and theoretical underpinnings were less emphasized by this school in their improvement process. The main outcome for the school team was that the intervention supported teachers' collaboration and integration of subjects:

> *Teachers are more involved in collaborative learning: the number of teachers participating in more than 1–2 integration projects has increased by about 20%; teachers make more suggestions to colleagues for collaboration.*

The majority of the decisions based on the collected and analyzed data were done in management level: improving the format of the collaboration days, identifying the needs for teacher training, sharing practices, and supporting documentation of the integration projects.

4.2 Research-based and data-informed decision-making in organizational level

School 4 focused on students' engagement in extracurricular activities. Interventions were carried out in teacher-student level and students' engagement was analyzed with observation sheets. Students' motivation was analyzed and teachers' feedback was collected with self-analysis:

> *We analyzed what emerged from the teachers' work analysis and students' motivation questionnaire.*

Theories and studies regarding students' learning motivation to support engagement were used as evidence to plan the interventions and data collection:

> *We used motivation theories, introduced by the university, to plan our intervention.*

Decisions were made mainly in the management level: observation process and techniques need to be improved:

> *Not everything is always visible—how to go on with the improvement of the observation sheet.*

More focus on supporting teachers' sharing of experiences and good practices was put.

Cases	Instructional level decision making	Instructional and organisational level decision making	Organisational level decision making
Data-informed evidence		School 3	School 1
Data-informed and research-based evidence		School 2 School 5	School 4
Research-based evidence			

Table 4.
The schools evidence-driven profiles.

4.3 Research-based and data-informed decision-making in instructional and organizational level

The aim of the school 2 was to implement different learning strategies to support the development of students' learning to learn skills. For monitoring the process, several data collection techniques were used: teachers' empowerment survey, survey about teachers' understanding of learning to learn skills, and teachers' interviews about different strategies. Students' self-analysis about the learning process was carried out; students learning skills and reading strategies were tested. Evidence from national-level satisfaction surveys was used when planning the activities and later analyzed:

> *National survey 2018 was used to plan the activities; National survey 2019 was used to analyze the state of the school.*

Approved training programs about reading and meaningful learning were used when designing interventions in collaboration with the university team. To support the collaborative culture, a teachers' professional learning community was initiated and research on teachers' professional community was used to support teachers' collaborative learning. Teachers in this group were also studied:

> *We conducted interviews with the teachers' part of the learning community.*

Decisions were made in management level (training and management support for teachers' to implement the new strategies to support students' learning to learn skills) and in instructional processes (new strategies will be implemented and students' self-analysis process more systematically enhanced).

School 3 aimed to raise the students' motivation to learn through more systematic integration of the lessons and outside of the classroom activities. Self-determination theory was used as a research ground in different activities:

> *In designing and conducting action research, we relied on self-determination theory.*

To analyze the effectiveness of the interventions, data were collected with the students' survey after each intervention (based on self-determination theory) and teachers' feedback. Evidence from the national-level students' satisfaction survey was used for planning interventions. Decisions regarding the future activities were made in students' level: focusing on explaining the goals of different learning activities to enhance the meaningfulness, enhancing students' skills to give feedback:

> *Students may not have taken the feedback seriously; the purpose of the survey should be better explained to the students.*

In management-level lesson, observations based on self-determination theory were developed.

The aim of the school 5 was to implement the meaningful learning experience for the seventh grade students through integrating more real-life situations to classroom activities. For data collection, an instrument was created to analyze to what extent students understand what they learn and how it supports their professional growth. Also, all the students were tested with scientific tests:

> *Grade 7 students took a motivation test and a social skill and learning to-learn skill test.*

Students and teachers gave weekly feedback, and teachers analyzed the students' evaluation sheets:

> *In addition to the paper-based feedback, we also received feedback from students electronically, which makes feedback for teachers more concise.*

Also oral feedback was collected from teachers and students for more in-depth analysis of the new experiences. Some evidence about the studies on integration of subjects was also used. To some extent, research results were also read by the team:

> *We read some research about integration of the subjects.*

Decisions were made mainly on management level: improving evaluation sheets, reformulating learning outcomes to make them easier for the students to understand. In the instructional level, teachers will focus more in the future to create shared understanding with the students about what learning outcomes mean and what students are actually expected to learn:

> *The teacher does not refer to the relation of the subject's learning outcome to everyday life, the result—teacher formulates the links between the learning outcomes together with the students.*

Also the plan to create individual learning paths for the students is in the focus for the future activities.

Our analysis indicates that all five schools participating in our program focused on collecting data and finding research evidence on the management level and three schools worked with evidence in the instructional processes. Four schools out of five focused on improving students' learning experience; one school focused on teachers' collaboration, but still with the aim to implement integration projects to improve teaching practices in the classroom level. It can be also concluded that all schools used data as part of their own studies to understand the effectiveness of the interventions, but the usage of the research evidence did not happen systematically in all of the cases. Schools collected data from both students and teachers; the instruments were mainly prepared by the schools themselves. In a few cases, additional data were collected with research instruments proposed by the university (testing the skills of the students for instance). Decisions made based on the data and research results were mainly focused on management level: improving everyday processes, data collection techniques, formalizing methodologies, and

better supporting teachers' collaboration. Some important decisions were also made on the student level: enhancing feedback skills, goal-setting of learning activities, enrichment of classroom activities, etc.

4.4 The enablers and barriers using evidence in school improvement program

Schildkamp and colleagues [5, 13] have proposed several factors influencing data use by school teams; they distinguish data use for accountability, school development, and instruction. In our research, we mainly focused on data use for school improvement and classroom-level instruction. Deriving from Schildkamp et al. [5, 13], we analyze the enablers and barriers of data use from the perspective of organizational, user and data characteristics.

Organizational characteristics include the shared vision, which includes a joint understanding about the nature of good teaching, student learning, and ways to evaluate the student learning. As our program focused on school improvement, building shared understanding about the change and ways to monitor the process were crucial. Schildkamp et al. [13] emphasize that effective data use also requires collaboration—teachers should share and discuss their students' results and their own functioning with students, parents, and teachers. In our case, all of the schools focused on improving teachers' collaboration and different solutions were found to find time to share experiences as part of the program activities. However, school 2—which created a teachers' professional learning community where the collected data were analyzed and results discussed—stood out among others for its evidence-driven school improvement practices. In our study, it was learnt that for the schools, it was difficult to design and conduct empirical studies (in action-research form) on their own (It is a very complex process for the school to develop research-based inquiry.) This was emphasized by the school that collaborated more tightly with the university experts to carry out research activities. On the other hand, same schools used more systematically research-based evidence in their improvement process than schools who used less university support in their activities. Therefore, the collaboration between the school team and university became very important in our study. Research data were used, but schools needed help in this regard, because it was challenging for the schools to understand what research data they could use and for what purposes and how to adapt the research-based solutions for their school settings. In our program, it was the role of the coaches to found experts, refer to the relevant studies, share validated tests and observation sheets to adapt, collect research data, etc. This relates well with Schildkamp et al. [13] user characteristics as well—data literacy of the teachers is something that needs promotion. It is not easy for the teachers to have the inquiry mindset, skills to collect data, interpret, and act based on the data. Mandinach [21] has concluded that pedagogical data literacy is the ability to transform information into actionable instructional knowledge and practices by collecting, analyzing, and interpreting all types of data to help specify educational steps by combining an understanding of data with standards, disciplinary knowledge and practices, curricular knowledge, pedagogical content knowledge, and an understanding of how children learn. Once teachers are prepared to work with the data, data characteristics—quick and convenient access to accurate data—also become very important. In our study, data-collection instruments were mainly prepared in collaboration with the university coaches and experts or by school teams themselves. It can be concluded that planning the data collection in collaboration with the university is something that schools can apply during the program activities. However, analyzing data quickly for feedforward purposes is something that needs further planning. For instance, school 4 who developed paper-based observation sheet learned that such documentation format

does not support instant decision-making for classroom-level instruction. And school 1 changed their paper-based surveys to electronic surveys in the middle of the program for more efficient data analysis purposes.

5. Further perspectives and practical implications

Our study indicated that in school-university partnerships, schools are able to acquire easier the mindset of evidence-driven improvement based on data collection, analysis by school team, or evidence from theoretical and methodological underpinnings. However, there are some aspects that need to be considered.

5.1 Human support

A coach has been suggested as one possibility to offer human support, which was also applied in the current program, and it can happen in school-university partnerships where the university coach guides the process. Facilitation by coaches includes assessing teachers' needs, modeling how to interpret and act upon data and observing teachers while they attempt to engage in the data-use process. It is recommended to design trainings for the school team with the following learning outcomes: learning the capabilities of the data system, understanding and using a cycle of instructional improvement, avoiding common data analysis mistakes, data transparency and safety, fostering a culture of data use, interpreting data in context, and using data to modify instruction. From the perspective of human support in the school-university partnership, our experience highlights the importance of the university coach. The school teams recognized the coaches help with practical questions and choices. This opens the discussion on the role of the coach in the school-university partnership. The university coach is often conceptualized in the literature as a data coach [7] or researcher [30] who pays attention primarily on evidence use. It may be too narrow of an approach if the final aim is to find and co-create innovative teaching and leading practices for school improvement. Yet, in our case, the profiles of the schools evidence-driven school improvement show that finding and selecting appropriate research-based evidence needs strengthening in the school improvement program. Also the main focus of the coaches was on bringing in theoretical frameworks, fostering a culture of evidence use and understanding the cycle of inquiry. The data analysis mistakes or accuracy was less emphasized by the schools. However, it was mentioned by one of the schools that they actually would like to get feedback if their inquiry design, data collection, and analysis are adequate.

5.2 Technology support

When technology training exists, it often focuses primarily on technological support and how to access the data management system. Studies show that schools pay efforts to have data systems that organize and analyze interim assessment data and data warehouses with current and historical student data. Our study indicated that elements to scaffold teachers to conduct teacher-led inquiry in the technology-enriched classroom as suggested by Hansen and Wasson [2] can be better supported. In our program, the data were collected rather traditionally—tests, surveys and questionnaires, mainly, and paper-based observation sheets. Focusing more on process-oriented data collection—with a variety of tools and efficient ways for classroom observations—timely access to students' learning results might influence the use of data for improving the classroom instruction. The growing use of

technology as part of teachers' practice opens up the possibility for a change from researcher-centered studies to teacher-centered approaches to inquiry [2].

5.3 Leadership

School principals are key players in facilitating data use among teachers—they play an important role in allocating resources and time to enable teachers to use evidence effectively. Their espoused beliefs about data use are critical, as they help to set the tone for data use in school teams. School leaders also have access to a variety of data, performance indicators, and study results; making these available for the teachers is important to enhance the data culture in the organization. However, we recognized that during the program, schools mostly used the data they gathered by themselves and the use of data gathered by or for the national or municipality level was used rarely. This raises the question of the capabilities to interpret such data by the school team, and capabilities to support and coach this interpretation by the university coaches. Moreover, our coaches could recognize some hesitations and doubts for using such data by the school teams because of the meaningfulness of the data gathered in this manner. We recognize the effective use of national data as an improvement area for the school development program.

5.4 Norms and designed routes

The schools are required to follow specific data-driven decision-making practices when developing their school improvement plans or for teachers to follow when using data to guide instruction. Providing structured time for collaboration is one of the primary ways that schools try to build teachers' capacity to use data. This includes adoption of data-discussion protocols in order to ensure that discussions about data occurred and that actions were taken on the basis of these conversations. Our program focused on understanding how can we better support schools in working with the data; in the next iteration of the program, we can more systematically focus on supporting the development of practices to create norms and routes for more systematic evidence-driven school improvement.

Our study demonstrated that in school-university partnership, when schools are scaffolded, evidence-driven practices are more widely adopted by the schools as part of the school improvement process. However, we also learned that the need for teachers to obtain complex data skills is becoming more and more important. Understanding about the inquiry process is just one angle of the challenge; also the understanding of how to read, interpret, critically evaluate, and act based on data is as important. In this iteration, the program did not systematically emphasize designing practices for collecting evidence from data and from the research, which could be better supported in the future. Also, we learned that schools understand quite well how to improve the practices in the school level based on collected evidence. Synergy between instructional-level data collection and decision-making, and organizational-level improvement can, however, be enhanced. In the future, it is important to analyze the impact of using classroom data in novel pedagogical and assessment approaches, and for teacher's professional development to determine if it changes the students' learning.

Our study also informs us how to improve initial teacher education and school principals' preparation in Estonia. The main practical implication is rooted in the dimensions of evidence-driven school improvement. Currently, in initial teacher education, students are expected to carry out action research project during their internship period. Individually they learn how to collect data in the teaching process. They do not experience how their collected data from classroom

interventions could feed the school improvement process and what is the relation between classroom-level evidence with school-level evidence. It can be concluded that it needs strengthening the dimension of evidence for school improvement in the initial teacher training. Additionally, current initial teacher training tends to prepare future teachers to collect action research data rather traditionally through surveys and interviews, but the usage of the learning analytics solutions as part of the inquiry could enable to monitor the practices more efficiently. Simultaneously, in principals' training program, topics like evidence-driven school improvement and schools' self-evaluation are rather theoretical. However, school principals need skills how to collect, analyze, interpret, and integrate data about instructional interventions conducted by teachers to plan improvements in school-level processes.

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Author details

Kätlin Vanari*, Kairit Tammets and Eve Eisenschmidt
Tallinn University, Tallinn, Estonia

*Address all correspondence to: katlin.vanari@tlu.ee

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Chapter 12

Parental Engagement in Children's Learning: A Holistic Approach to Teacher-Parents' Partnerships

Cristiana Levinthal de Oliveira Lima and Elina Kuusisto

Abstract

This study presents the standpoint of parental engagement, conceptualized by Janet Goodall and collaborators, as a framework that is coherent to the principles of the holistic approach of pedagogy to teacher-parents' partnerships. We bring forward the evolution of the concept of parental engagement and its main standpoints, in relation to more traditional theories on parental involvement. We also discuss previous findings about teachers' and parents' roles in education and teacher-parents' partnerships, as well as how do changes in educational paradigms challenge home-school collaboration. Finally, the article highlights the need to implement research-based parental engagement practices in educational systems around the world.

Keywords: parental engagement, parental involvement, teacher-parents partnership, teacher-parents dialog, home-school collaboration, holistic education, children's learning

1. Introduction

Partnerships between parents and teachers regarding students' education have been a well-researched topic throughout the past three decades. Much more recently, both research and practice contexts started adapting their perspectives on the centrality of the parents' role in their children's learning [1–5]. Such a shift is embedded in a mainstream worldwide tendency to adapt the goals of educational systems to an ever-changing and globalized world, targeting to develop not only competences in individual fields of knowledge, but also transversal competences, such as, for example, learning to learn, cultural competence, and entrepreneurship [1]. These changes, stimulated by the latest educational reflections within the scope of the Organization for Economic Cooperation and Development [5] are deeply framed by the holistic approach in education.

In pedagogy, the holistic approach refers to the development of the whole student, underlining all the dimensions in which he/she can learn and grow as an individual, for example, cognitive, social, emotional, and spiritual dimensions [6]. This approach faces such dimensions as interdependently relevant to the well-being, healthy development, and success of the student and carries the notion that each student is the expert that guides his/her own learning process in life [7]. The adoption of a holistic approach in education requires, consequently, a role re-conceptualization of both teachers and parents.

It is important to address that, in this article, *parents* refer to any legally entitled adult who takes care of the children and are seen as reference figures by them, while *children* and students have equivalent meaning. This study presents the standpoint of parental engagement, conceptualized by Janet Goodall and collaborators, as a framework that is coherent to the principles of the holistic approach of pedagogy to teacher-parents' partnerships. First, we bring forward the evolution of the concept of parental engagement and its main standpoints, in relation to more traditional theories on parental involvement. Second, we more deeply discuss previous findings about teachers' and parents' roles in education and teacher-parents' partnerships. Third, we address the actual challenges such an educational paradigm brings to stakeholders, especially teachers. Finally, a conclusion is drawn, highlighting the need to implement research-based parental engagement practices in educational systems around the world.

2. From involvement to engagement

There is a consensus in research regarding the favorable impact of parents' positive attitudes and behavior toward their children's learning, schooling, and schools [8–11]. Indisputably, research has shown that such parents' emplacement impacts positively students' academic achievement as well as learning in a broader sense [10, 12–14]. However, such a set of desirable parents' attitudes and behavior has been conceptualized in numerous different ways. Researchers are far from unified regarding the terms and so are school professionals. The most traditional termination to describe various types of parents' participation in education is *parental involvement*.

Research on parental involvement in education has mostly focused on the positive repercussion parental involvement has in students' achievement, achievement-related self-perceptions, and autonomous motivation [8, 11, 15–18]. Thus, there has been agreement that parental involvement is a multidimensional construct. On the other hand, most of the research conducted on involvement in the past decades is based on influential frameworks that conceptualize it in terms of parents' participation in children's schools or schooling, in other words, in the processes *surrounding* learning *in* school [19, 20].

Grolnick and Slowiaczeck [11] have stated the importance of integrating both educational and developmental constructs in the perspective of involvement, underlining the significance of *home-school partnerships* to the children's schooling. Hence, they built a framework that identified three types of parental involvement in the child's schooling:

a. behavioral, (e.g., participating in activities promoted by the school, such as parents' evening);

b. personal (e.g., positive child-parent affective interactions about and around school, such as parents' assistance with homework);

c. cognitive-intellectual (e.g., exposure to cognitive-stimulating events and materials, such as books, that would help the children practice skills *useful* in their schooling, like reading).

Later, Joyce Epstein [9] postulated a six-type model for parental involvement. In her model, Epstein underlines the concept of partnerships between parents and educators numerous times and calls for school staff's key role in involving parents. Her framework includes (1) parenting; (2) communicating; (3) volunteering;

(4) learning at home; (5) decision making; and (6) collaborating with community. Epstein's framework [9] seems to pursuit an even more home- and parent-related standpoint for academic success, enhancing the value of the home context and figures. Within each of the six types of involvement, the author highlights, based in a solid cluster of research findings, numerous advantages of involving parents in schools—for students, for teachers and for parents themselves [9].

Despite of viewing involvement from the perspective of ecological systems theory [21], considering various system levels that influence children's development (e.g., family, school, and community), Epstein's model is still school-centered, attached to a perspective of fulfillment of schools' needs and academic success of the students. For example, regarding the first type of involvement described in the model, *parenting*, the central goal is to help families establish home environments to support children as students, such as suggesting home conditions that support studying; or providing school meetings that would help families to understand the school functioning. Concerning, for instance, the forth type described in the model, *learning at home*, the emphasis is put on informing parents about skills required at each grade level, providing regular homework schedules or providing opportunities for families to attend math, science and reading activities at school [9].

The models of Grolnick and Slowiaczeck and Epstein highlight two main domains of involvement: *school-based* and *home-based*. School-based involvement is linked to activities where parents interact with teachers and the school community, home-based involvement refers to assistance with homework, study support, and talking with children about school [16, 22]. Still, both models imply the assumption of the parents' role as an assistant to the school's or the teachers' goals. Nevertheless, research has already shown that the relation between academic outcomes and parents' *school-based* involvement is *weaker* than between those and parents' *home-based* involvement [15].

In recent years, the body of research pointing to the centrality of effective teacher-parent communication and partnership have begun to expand consistently [23, 24], giving parental involvement a more family-centered approach and, consequently, questioning the involvement-concept and its adequacy. It has been strongly suggested that the termination *involvement* should be discarded and replaced [23].

In parallel, the term parental engagement has been gaining space in research on home-school partnerships and shedding new lights on the topic [4, 25–28], mostly in the United States and the United Kingdom. This is the case especially regarding studies focused on parental involvement from a comprehensive point of view, seeking to understand not only the parental role in academic success but also their role in teacher-parent communication and parent–child interactions outside the academic sphere (e.g., parenting styles and non-academic related activities away from school) [29, 30]. Similar perspectives can be found on educational policies documents of international organizations [31, 32].

From that standpoint and based on several findings and influential theories [33, 34], Goodall and Montgomery [10] built an original up-to-date framework on parental engagement, where previous parental involvement practices are included and extended.

Goodall and Montgomery's model [10] places emphasis on parents' relationship with their children and their children's learning, in *and* outside school, academically *and* non-academically, not on the parents' relationship with schools or children's schooling, as in previous models.

Goodall and Montgomery's model presupposes that the children's learning occurs in all varieties of contexts that largely surpass the school environment, giving the home environment and experiences, as well as other contexts mediated by parents, an enormous relevance as children's learning scenarios. This model is presented as a *dynamic continuum* of three main points, throughout which parent-teacher dyads can move

along on the course of their interactions concerning the child's learning. A summary of characteristics, examples, and benefits of each of the points are presented in **Table 1**.

By observing the information in **Table 1**, it becomes clearer that the third point of the continuum, parental engagement, integrates the positive characteristics of

		Point 1 Parental Involvement with school	**Point 2 Parental Involvement with schooling**	**Point 3 Parental Engagement with children's learning**
Characteristics	**Communication**	Superficial level; flows one-way, from school; regards children's progress and little dialogue	Deeper level; flows both ways; initiated by both; regards children's schooling	Deeper level; flows both ways; initiated by both; regarding children's learning
	Time	Very little, insufficient	More time from school	Sufficient time from school
	Interchange	Between parents and school	Between parents and school; between parents and children	Mostly between parents and children; between parents and school
	Teachers	Control relationship and give parents important information	Seek information on children's home life; listen to parents and help reframe mindsets regarding learning	Seek information on children's home life; listen to parents and help reframe mindsets; eager to learn from parents
	Parents	Recipients of school and school staff information; schools' and teachers' helpers/assistants	Active contributors to children's academic future	Central figures in children's learning; aware of their role as parents regarding school and home
Examples		Parents' evenings of 10 minutes for each student's parents; parents' attendance to classroom to hear children reading	Teacher-parent conferences with two-way flow of information; parents' assistance in homework at home	Parents' interest in children's learning; open parent-child channels of communication about children's learning and life experiences; parents' attitudes and aspirations on children's learning; parents' providing of multiple learning experiences (e.g. music, dance, scouting)
Benefits		Starting point to ground a better future relationship; transfer of important information	Fuller picture of the child; better relationship built on trust and dialogue; breaks down barriers for engagement; shared power (partnership)	Raises children's achievement, self-esteem and aspirations; increases children's motivation and engagement in learning

Note: The information was extracted from Goodall and Montgomery [10] and compiled by the author of the present article.

Table 1.
Summary of the parental engagement continuum framework.

the previous two points, since it portraits an *authentic partnership* between teachers and parents. According to Goodall and Montgomery [10], while moving in the continuum, the closer parents and teachers get to the third point, the higher the level of *shared agency* and *shared responsibility* they experience concerning children's learning. The same is true regarding the frequency of involvement activities happening away from the school context and closer to the home context. Here, in contrast with previous conceptualizations on parental involvement, parental engagement refers to more than the parents' activity or participation—it encompasses a *greater commitment and a greater feeling of ownership of the action*, where the parent is *conscious* about his/her role as a parent [10]. Howbeit, this perspective on parental engagement does not compete with parental involvement; on the contrary, it integrates and complements it.

Thus, through this model's lenses, a true teacher-parent relationship encompasses reciprocal open mindsets, where both teachers and parents learn from each other, show mutual interest in what each other has to say, and have a genuine concern about not only the schooling success, but about all other life contexts that are significant for the child. Here, parents' levels of expertise on their own children are valued by teachers and their role is elevated, both teachers' and parents' perspectives matter and both have *equitable distribution of agency* regarding the children's learning [10].

The presented framework allows analysis and comprehension of the important relationships between parents and teachers, regarding the children's learning, from a holistic perspective. The word *engagement*, instead of *involvement*, refers to a broader and globalizing construct, as well as a more active and more genuine attitude from parents. Also, the choice of the term *children's learning*, instead of *children's education*, indicates that this framework views the learning process as one not attached to the classroom or the school, but intrinsic to the development of the student as a whole individual, in all contexts of life that concern cognitive, social, moral, emotional or spiritual growth. In addition, Goodall [35] also brings up the term *dialog*, as it is considered to better define a two-way communication pattern in a partnership.

However, it is important to address that the third point, as well as the whole continuum dynamics, refers to an ideal framework, one that parents and, especially, teachers should aim to [10].

2.1 Teachers' role on parental engagement

Although *involvement* and *engagement* are not synonyms, in this article, we take the studies adopting the involvement concept into account, as we consider mandatory to acknowledge them in order to reach an accurate comprehension of parental engagement and its relevance to children's learning. *Involvement* and *engagement* share paths both in research and practice, as the latter derives from the former. Therefore, we consider they should not be dissociated.

Teachers are central stakeholders in education and constitute cohorts of powerful agents for change, due to their training, specialization, and experience [12, 36]. Teachers' psychological and behavioral characteristics regarding the involvement of parents have been strongly associated to parents' actual involvement [8, 30, 37]. Additionally, although teachers are more successful in involving parents during the initial levels of schooling [38, 39], they continue to act as key figures for parental engagement throughout all levels of children's academic life, especially regarding difficult pupils and hard to reach families [40–42].

Research has evidenced that teachers consider families' involvement important to the students' school success, recognizing that parents are positive contributors. Howbeit, the majority of these studies focused on the home-based academical

involvement of parents (e.g., reinforcement of the learning that occurs in school, especially in supporting homework at home), pointing out such forms as the most valued types of parental involvement [43–47].

In different cultures, teachers' conceptualizations and practices have been focused on and proven to be crucial to parental involvement, in particular for those parents who have difficulties in being involved [41, 42]. These include the emotional climate experienced when teachers and parents interact, including the time dedicated to effective communication and dialog, but also other aspects, such as teachers' self-efficacy and role beliefs, expectations about involvement and specific practices to promote involvement [13, 37, 48–51].

Improving home-school effective communication has been identified as a primary way to enhance trust between teachers and parents, as well as has the *nature* of the teacher-parent interaction proven to be a better predictor of trust than the frequency of interactions [12, 52–54]. This means that it is more important that each dialog makes teachers and parents feel heard and respected, even if there are not so many of them, than to keep constantly in touch without the feeling of true commitment and interest from the other part.

Much of what is considered to be structurally necessary for an effective dialog in teacher-parent interactions lies in the teachers' set of competences such as managing the time dedicated to talk to and *actively listen* to the parent and making sure that the specific goals of the contact are met [55]. Although both teachers and parents reveal their highest level of trust in each other at the elementary level of education, parents tend to trust teachers more frequently than the contrary [52]. This fact puts teachers in the spotlight again, regarding the major role they play in building a reciprocally respectful and considerate relationship with parents.

Parental involvement is greater when parents feel that teachers include them and value their contributions [37, 56]. In fact, teachers whose expectations are that the parents can contribute to the children's learning are more likely to involve parents than those teachers who have low expectations on the competences of their students' parents [13, 54, 57]. Teachers' support of parents to learn how to help their children is appreciated by parents [54] and teachers' invitations for involvement are positively responded by parents [30], which gives teachers' solicitations an important and predicting role on the dynamics of parental engagement. Additionally, teachers' self-efficacy perceptions on parental involvement has been significantly related to involvement itself, also functioning as a predictor [11]. These studies corroborate the importance of student teachers having an academic path that highlights parental engagement strategies and attitudes.

On the other hand, and despite agreeing that home-school collaborations are essentially important, teachers and parents differ in opinion about the extent in which each other actually meet their expectations. Research has shown that often teachers and parents have incongruent parents' role perceptions and that teachers expect parents to perform academic-related tasks in the home more frequently than parents do themselves, both in primary and secondary levels [43]. This adds, once more, to the evidence on the power teachers do have, to change the perspective from *involvement* to *engagement*.

2.2 Parents' role on parental engagement

Parent's influences on their children's achievement have been largely studied [8, 11, 16, 18]. Factors like parents' socioeconomic status and educational background are known to act as predictors of students' achievement and school adaptation, as well as of parental involvement [9, 42, 58]. Literature is also consistent about the positive response from parents toward their children's learning, regarding

teachers' expectations and solicitations of parental involvement [13, 37, 49, 50], which is believed to contribute to the parents' role of themselves and for them to view their own participation as important, through the teachers' eyes.

However, in comparison to research on teachers' role and perceptions or studies where both teachers' and parents' attributes are analyzed regarding children's academic success, only more recently, parents' role and perceptions started gaining significant space as objects of study on parental involvement [19, 59, 60]. That can be explained, in some extent, due to the history of school and home contexts' instituted views of each other as entities with different and complementary objectives [52, 61], where children's schooling was a school duty and children's basic well-being and healthy development was attributed solely to parents. Lately, as these two tremendous tasks increasingly merge into each other, the role of parents' attitudes and behavior is being progressively more taken into account, from a holistic point of view.

Today, we know that parents who believe that their own role is important in affecting their child's achievement in school tend to more often facilitate the development of their child's interests, in comparison to parents who do not view their role as important [20]. Role beliefs identified in research are, in part, related to what modern expectancy-value theory refers as task-value [62]. Task-value beliefs are key determinants of choice, persistence, and engagement in tasks. Eccles and Wigfield [62] outlined four components of task-value: attainment value, intrinsic value, utility value, and costs. Regarding parental engagement, these components would refer to (a) the personal importance the parent would attribute for positively contributing to their child's learning; (b) the genuine enjoyment the parent would feel about doing so; (c) the relation the parent attributes between positively contributing to their children's learning and their own personal goals in life; and (d) the amount of effort or negative experiences a parent feels they have to go through in order to do so.

Recent findings point out that enjoyment and genuine interest of parents about their children's learning have life-long positive impacts. Parents who read recreationally to their children at young age and who talk informally to their adolescent children around a table, about political or social issues, are more likely to have a significant impact on children's life and school outcomes than those parents who do not [32]. These kinds of *engagement* practices from parents since young age of their children, impact not only children's language skills later on, but also their development of valuable transversal competences, such as ability to plan, set their own goals, initiate and follow through in their studies and individual projects.

Various authors [2, 22, 30, 63, 64] have recently studied the impact of parental styles at home. Goodall [2] points to the *authoritative style of parenting* as one that effectively supports children's learning throughout their lives, once it encompasses parental warmth, discussion, and appropriate level of control regarding the stage of development of the child, underpinning parental interest and involvement in children's learning. Accordingly, Silinskas and colleagues [14, 29], concluded that, regarding parents' support in homework at home, the most beneficial style of parental involvement is the one that is autonomy supportive, process focused and that includes positive effects and positive beliefs from the parent. These findings support, once more, the significance of *parents being conscious about their role* and *being expected and solicited* by their children's teachers to engage.

As the role of parents in engaging in children's learning is acknowledged to be such an essential element in the children's lives, in and outside school, research also underlines the existence of a pattern in the quality of the child's affective relationship with parents and with teachers, since children seem to have a concordant evocative impact on both parents and teachers [14]. This gives teacher-parents' partnerships even more centrality, once teachers, as professional educators, have

opportunity to identify and break such patterns when they are not effective for the child's sake [24, 65, 66]. In such cases, teachers have the ability to comprehend more complex home dynamics such as those of students from diverse cultural or socioeconomic backgrounds, *listening to* parents that may be little engaged as well as instructing them about more effective attitudes and behaviors in the home [28, 40].

2.3 Challenges for parental engagement

Surpassing the sphere of children's academic achievement or school engagement, teacher-parents' partnerships are nowadays seen as a powerful tool for breaking undesirable patterns. It has been considered an extremely important element on equity issues in education when built on effective teacher-parent dialog [40, 42]. Yet, this scenario is not prevalent in most schools around the world, since, as Goodall [3] attests, the most popular perception of working with parents is still *school-centered* instead of *learning-centered*. This means that the traditional *involvement* approach to parents is still much more often used in schools than the more effective and integrative approach presented by the parental *engagement* framework.

Despite the growing knowledge regarding parental engagement in a larger sense, one of non-dependence of the school environment, many are the obstacles for engagement to take place in schools and homes around the world. Some of them have been around longer than the others, which make it even more difficult for the school community to tackle them, as they seem to pile up. For instance, the lack of resources such as time and personnel, in many schools, prevents teachers from developing consistent approaches for parental involvement itself, let alone practices of engagement, that demand an even superior amount of time and follow-up dialogue between teachers and parents. Some of the linger drawbacks for involvement and engagement practices also list: lack of support from schools' administration or simply a set of school's beliefs that do not favor teacher-parents' partnerships; mothers' over fathers' representativeness in schools; and difficulty of maintaining or establishing effective home-school dialogue throughout the levels of schooling.

Regarding the institutional level, leaders such as the school's headmaster or department's head teachers may or may not adopt a facilitator role to involving and engaging parents [67]. For the engagement path to be accessible, it is essential that a consistent definition of parental engagement is shared between school's administration, teachers, and parents of a specific school, so all these cohorts are able to develop realist and shared expectations about each other's roles [68]. Thus, headmasters and head teachers have a decisive role on the development of a school culture which values the engagement of parents in the children's learning [69].

Such school's guidelines can also make a difference in engaging *both* mothers and fathers in the children's learning and therefore turning engagement even more effective. It is true, for both research and practice, that even though, today, families as institutions encompass much more different structures and dynamics than 15 or 20 years ago, the presence of mothers is still more common regarding school- and education-related issues, over the presence of fathers [64, 70, 71]. This constitutes an obstacle for engagement as each of the child's parents have their unique relationship and perspective regarding their child [72], and a fuller picture of the child's home life is only possible when the teacher can reach both mother and father. Also, any needed positive impact of what the teacher may recommend is multiplied when both mother and father establish an authentic partnership with the teacher.

Another well-known stumbling rock for parental engagement, that is cited above, constitutes the difficulty of maintaining or creating teacher-parents' partnerships as children grow in age and grade level. As children develop into young

adults, the nature of their relationships with adults and peers changes, as they look forward to a progressively more independent life, which originates a growing distance between teacher and parents dialogs [73]. Additionally, in most countries, as children progress in education, the number of teachers grow, fact that also handicaps teachers-parents' partnerships and holistic education. In that matter, Goodall [35] encourages that schools explore the numerous possibilities technology provides for engagement of parents of older students as well as busier or hard to reach parents (e.g., e-mail, texting, and specific channels of communication).

Technology transports us to a more recent range of challenges for parental engagement, together with diversity in classrooms and teacher education programs.

Despite the lack of research in the topic, that, as Goodall [35] herself attests, consists in a very difficult theme to study appropriately, the transformation in the major routes of communication between teachers and parents has crucially changed in the last few years. In Finland, for instance, digital communication has become the primary means for teachers and parents to communicate [74]. The advance and accessibility of technology consist of an advantage for parental engagement, when the tools are well used by professionals, for example, as it helps professionals to communicate with parents more efficiently and reach a higher number of parents in a little amount of time [35]. However, these practices elicit new and unknown difficulties that need to be outpaced by schools. As pointed out in Finland [74], such strategies may shorten distances with a specific group of parents, such as the ones from rural contexts, but other groups may feel they are not given enough space to communicate as teachers would think. The lack of substantial education of teachers on how to use technology to improve teacher-parents dialogue, during their trainings, needs to be tackled in order to bring schools and homes together [35, 74].

In fact, teacher education needs reflections and updates in many parts of the world. In Portugal, for example, only 39% of lower secondary teachers reported feeling prepared, by the time they had finished their studies, to teach in cognitively diverse settings and 27% reported a strong need to receive formal education in this area [75]. Classroom diversity certainly challenges teachers, often causing tense relationships to emerge with parents. To respond this and other flaws, a huge educational reform based on a holistic approach has been recently implemented by the Portuguese government [76], even though no additional training for practitioners have been made available, so far.

Finally, and because education needs to be approached from an ecological systems perspective [21], one of the greater challenges for parental engagement dwells not only in the classroom, but in the community and the society. Along with globalization, teachers all around the world must deal with a rising diversity of students and parents, which demands teachers to have a creative, sensitive, and versatile attitude toward parents. Such diversity requires a greater amount of resources from the teacher than it does in cases where he/she deals with more uniform groups of children.

3. Conclusions

In a primary contact, parental engagement may seem complex and sometimes even utopic. The holistic approach to pedagogy calls for a holistic approach to teacher-parents' partnerships and vice-versa: one cannot fully achieve its goals without the other. It is probably one of the main reasons it has been so difficult even for well-intentioned and well-educated teachers to introduce engagement practices and to break the traditional cycles where schools ask parents for more than they can give and the whole family ends up feeling frustrated.

After a closer look, one may realize engagement practices have, in fact, a simple foundation. It is based on authentic interactions, true acceptance, trust, and believe in bringing out the best of each family; it goes beyond interacting as teacher and parents—rather, refers to interacting as whole individuals that are sensitive about each other's needs, beliefs, and ideas and instead of competing with each other, unify their strengths for the common goal of the child's success in life.

For a teacher of a holistic classroom environment who wants to develop a closer and an authentic partnership with his/her pupil's parents, there is a need to preserve his/her attitude in the classroom, reflecting it in the interactions with the parents [3]. If the teacher has the goal to prompt the development of the student as a whole person, then, first, the teacher needs to *see him/herself* from a similar perspective, including when establishing partnerships with parents. The paradigm of education has been strongly changing around the world, from one that the teachers hold the truth about all academic content to one where the students are strong contributors for learning. Accordingly, the paradigm of teacher-parent relationships shall necessarily follow the same principles. Teachers are not, anymore, the only ones to have valuable information to transfer to parents and parents are no longer merely recipients of information on children's accomplishments and behavior outcomes. Instead, parents' knowledge and thoughts must be heard and appreciated, because they carry equally valuable information about children's learning and development as the teacher does.

Beyond all challenges presented before, it has been difficult to move from an *involvement* to an *engagement* perspective because whereas the former allows teachers and schools to address request in a regular basis, the latter demands teachers to reflect about themselves, as professionals and individuals, and implies that schools let parents in as *equal* partners. Engaging parents shall, necessarily, be viewed as a team effort, not an individual task. Schools' leaders are more decisive in the way parents play their role in children's learning than it has been pointed out until the date [77].

However, as stated above, engaging parents demands a deep reflexive attitude from the teacher—one that most likely develops through practice and meaningful internalization processes of knowledge [78]. "Beginning teachers need to be encouraged to develop a moral stance in relation to their professional responsibilities" ([78], p. 33) in order to meaningfully develop the ability and sensitiveness to stablish authentic partnerships with all parents. The teacher's professional knowledge will reveal itself in pedagogical decisions that cannot be dissociated from his/her own principles and values. This means that each student teacher's path will be unique and will be shaped by the formal education they will receive, the thoughts and discussions they will encounter during this period, and the moral choices regarding values and principles they will make along the way.

A purposeful teacher looks for not only fulfilling his/her own goals in life but has a profound sense of beyond-the-self impact and self-transcendent goals [79]. Teacher education can establish optimal contexts to foster student teachers' sense of purpose in life and in teaching, self-knowledge, and reflection ability. Methods that involve guided analysis, group, and individual reflections and are based on authentic cases from student teachers' past experiences in school [79] seem to offer a promising wellspring for teaching how to engage parents. This could involve, for example, student teachers' recollection of memorable learning experiences with their parents, reflection about the meaning and impact it had in their studying-learning process and reflection about their teachers' attitude toward parents at the time.

Practitioners' and researchers' efforts, through research-based practices and practice-based research, are crucial in giving life to such a framework in schools and homes, more and more as years go by, and making the holistic approach more than a *utopia*, but a reality.

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Author details

Cristiana Levinthal de Oliveira Lima[1*] and Elina Kuusisto[2]

1 University of Helsinki, Helsinki, Finland

2 University of Tampere, Tampere, Finland

*Address all correspondence to: cristiana.levinthal@helsinki.fi

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This book takes a holistic approach to pedagogy and argues that the purpose of education is to educate the student's whole personality including cognitive, social, and moral domains. The four sections and twelve chapters address the current pedagogical challenges in basic and higher education in international contexts. The authors describe the principles and practices through which meaningful education is promoted and enhanced in a variety of ways. The challenges educators face in their profession as well as ways to overcome them are elaborated on both theoretically and empirically. The book allows both researchers, teachers, and educational policy makers to reflect on current developments, challenges, and areas of development in educational institutions when aiming to support student growth and learning.

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