



# Journal of the International Society for Teacher Education

Volume 24 Issue 2

Diverse aspects on Education:  
Perspectives from the World



**WEBER STATE UNIVERSITY**  
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# **Journal of the International Society for Teacher Education**

Diverse Aspects on Education:  
Perspectives from the  
World

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## From the editors – About this issue

By Karen Bjerg Petersen, David Byrd and DeeDee Mower, Editors of JISTE

We are pleased to present the current issue of the Journal of the International Society for Teacher Education, JISTE, Volume 24, number 2. Some of the articles in this volume were presented at the annual ISfTE seminar, convened in May 2019 by Leanne Taylor and Vera Woloshyn from Brock University, Canada. Other articles were meant to be presented at the annual ISfTE seminar in 2020 in Bhutan, convened by Kezang Sherab and Ugyen Choden, Paro College of Education at Bhutan Royal University, Bhutan. Due to the Covid-19 pandemic, this year's seminar in Bhutan was however cancelled. Finally, some of the articles in this open issue are submitted to our journal from scholars outside the ISfTE society. A double blind review process and a comprehensive English edit has taken place before publication.

JISTE 24.2 is featuring the theme “Diverse Aspects of Education: Perspectives from the World”. The titles and content of the articles in JISTE 24.2 evidence that education researchers and teacher educators throughout the world address many diverse and very different aspects of education. The authors in this issue span a wide field of research ranging from studies in education policy analysed from new perspectives such as psychoanalysis over interests in subject teaching, teacher education background and student well-being to investigating aspects of the current covid-19 pandemic in areas of the world. The authors in this issue also represent a diversity of geographical areas of the world, from Tamil-Nadu (India) and Bhutan in Asia over Nigeria in Africa to northern countries in Europe.

In her article, *The placebo effect in education? Evidence-based educational practice and the psychoanalytic concept of transference*, Kirsten Hyldgaard from Denmark takes a philosophical and psychoanalytic stance in discussing current trends in education policy. In particular, the author criticises the concept of evidence and the demand for evidence-based practice and decision-making in education. Claiming that proponents of such approach transfer treatment and scientific approaches from the field of medicine to education without discussing which place double blind, placebo-controlled clinical trials – playing a crucial role in medical science – might have in the field of education. The author suggests the concept of transference from psychoanalysis as a useful way to explore processes and mechanisms leading to the placebo effects.

In the article *Students' mental health, stress, academic anxiety and knowledge of covid-19 among higher education students*, P. Janardhana Kumar Reddy from India addresses an important and extremely relevant issue for the year 2020, witnessing the pandemic of covid-19. As the author emphasizes, “COVID -19 is a wide-reaching health emergency which makes the globe to a standstill with supreme and unexpected impact in our life”. In the article, the author examined mental health, stress and academic anxiety among students (n=883) of higher education in Tamil Nadu, India revealing – in the beginning of 2020 - a significant difference in Covid-19 crisis knowledge and about the pandemic situation of the higher education students of India with respect

to sex, course of studying, discipline, and higher education institutions.

In the article *Impact of classroom well-being on student learning: Bhutanese students' perceptions*, written by Kinley Seden, Kinzang Dorji, Sonam Wangmo, Wangmo from Bhutan, the authors examine impact of classroom well-being on student learning in a qualitative study. Based on semi-structured interviews and classroom observation, the authors identify that classroom well-being plays a role in enhancing student learning. Furthermore, lecturer competence and classroom management, interpersonal relationships, instructional resources play an important role for the thriving of student well-being.

In their article, the authors Frøydis Nordgård Vik, Cecilie Beinert, Päivi Palojoki, Elisabet Rudjord Hillesund, Dagrun Engeset, Anne Selvik Ask, Gun Åbacka and Nina Cecilie Øverby from Norway address *Differences in formal education among Norwegian Home Economics teachers* because many of these teachers do not have a formal education. Based on a questionnaire to all home economics teachers in Norway in the year 2018, the authors found that a higher proportion of the formally educated group showed more contentment with teaching and reported to a greater extent mastering teaching compared to the non-educated group. The authors suggest an extension of formal education to including all home economic teachers.

Sabainah Oyebola Akinoso, Aminat Aderonke Agoro and Olufemi Mobolaji Alabi, Nigeria in their article, *Effect of station rotation mode of instructional delivery for mathematics in the era of advancing technology* introduce the station rotation model of instruction as a teaching approach in math combining normal classroom teaching with a variety of online resources. In their study, the authors compare the use of blended learning in teaching math in schools in Nigeria with classes in which a traditional face-to-face teaching method is applied. Their findings indicate that the use of blended learning in teaching math improves the teaching, the learning and the outcome of the students.

Cornelia Brodahl, Niclas Larson, Unni Wathne and Kirsten Bjørkestøl from Norway are the authors of the article *Developing further support for in-service teachers' implementation of a reasoning-and-proving activity and their identification of students' level of mathematical argumentation*. In articles - of which the current is the third - published in JISTE focusing on reasoning-and-proving activity, the authors have investigated in-service teachers teaching math in grades 5-10, enrolled in a continuing university education programme in the years 2018 and 2019. Qualitative content analysis of the two cohorts' justifications of their identifications, revealed an improved understanding of what is considered generic argumentation. According to the authors, the results encourage and contribute to further development of the concept.

The articles in this issue of JISTE witness the continuous engagement, which represent the dedicated educators throughout the world and demonstrate a deep interest in the many and diverse aspects and angles of education, teaching, and learning.

Finally, we would like to thank the reviewers, who have contributed with several and repeated reviews on the submitted articles for this issue. We are grateful for the active support from scholars from all over the world, members and non-members of ISfTE, who have spent their time and used their expertise to review the manuscripts.

# THE PLACEBO EFFECT IN EDUCATION? EVIDENCE-BASED EDUCATIONAL PRACTICE AND THE PSYCHOANALYTIC CONCEPT OF TRANSFERENCE

**Kirsten Hyldgaard**

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## **Abstract**

The concept of evidence, the demand for evidence-based practice and decision-making has for years dominated educational research. Concomitantly, the randomized controlled trials (RCT) that originally gained ground within the field of medicine have become the gold standard for empirical research and political reform within educational sciences, at least in Scandinavia. Nevertheless, proponents of such an approach have not fully explored the consequences of evidence-based methods, in particular the double-blind, placebo-controlled clinical trial. What is the equivalent to the placebo-effect in education and how does research in educational sciences deal with this effect? The concept of placebo is arguably as close as medicine gets to acknowledging the psychoanalytic concept of the unconscious and unconscious knowledge. With the concept of transference, psychoanalysis offers a useful exploration of the processes and mechanisms leading to the placebo effects.

**Keywords:** placebo, double-blind test, transference, unconscious knowledge, ego ideal and ideal ego

## **Introduction**

What do teachers do when they fail, when what is supposed to work does not in fact work? What recourse do teachers have when they are bewildered and powerless? How do teachers explain when pupils or students seem to be beyond the reach of educational methods?

One option is either to put the blame on the teacher for being incompetent or to put the blame on the pupil, the student – he or she is considered to be impossible or lazy. Failure is personal. Another option is to blame the method; it is in fact not as effectual as promised by researchers. Failure is a question of method. This article suggests a third option: failure is not necessarily a question of either personal incompetence or ineffectual didactic methods. Failure can be a question of unconscious transference and resistance between pupil and teacher.

Why do researchers in the field of educational sciences, such as the highly influential John Hattie (2009) and, following Hattie, the Danish researchers Niels Egelund and Lars Qvortrup (2013), who defend the concepts of evidence-based research and practice and, in particular, the methodology of Randomised Controlled Trials (RCT) ignore what is referred to in medicine as

the placebo effect, i.e., the well-documented phenomenon that trust in the doctor and the drugs or treatment he or she prescribes in itself has a curative effect? After all, the placebo effect raises the question of whether, rather than pharmaceuticals, it is the dynamic relations between doctors and patients that result in a cure. Transferred to the field of education, the obvious question to ask goes: Is it didactic methods or the bonds between teachers and students that have primacy in determining learning outcomes?

As a matter of routine, researchers in medicine take this variable – the placebo effect – into consideration (Shapiro & Shapiro, 1997). Despite the fact that medical sciences can neither explain nor control placebo effects, they do not ignore them. On the contrary, they recognize the importance of the relationship between doctor and patient. Why do educational scientists who refer to RCT as the gold standard ignore this question, considering that education concerns relationships between teachers and students about a subject? After all, educational sciences are not concerned with biochemical causality.

### **The Double-blind Test**

In RCT, the research design is double-blind when neither the researcher nor the patient know whether what they respectively hand out and receive is test medication or a dummy pill. Why must the researcher be kept in the dark? The answer is not that otherwise the researcher could cheat; confidentiality, professional secrecy has always relied on trust. Rather, it is because researchers cannot control how their knowledge affects their conduct. The researcher's knowledge is somehow communicated to the patient; the patient reads the researcher's knowledge. Apparently, the researcher's expectations, maybe even enthusiasm about the new, promising cure affect his or her tone of voice and body language, which in turn is registered by the patient in his or her desire to please – hence placebo – by living up to the researcher's expectations for the cure. In other words, the question of placebo is the closest medicine gets to an acknowledgement of both the Freudian concept of transference and the Hegelian and Lacanian claim of “Man's desire is the desire of the Other” (Lacan, 1998, p. 235).

The trust in and the expectation of a curative effect is in itself a cure. Shapiro and Shapiro (1997) argued in *The Powerful Placebo. From Ancient Priest to Modern Physician* that, “[...] history provides ample evidence for the hypothesis that until recently the history of medical treatment was essentially the history of the placebo effect” (p. 2). As they state, only occasionally and at great intervals have cures been proven to have a causal effect such as the cure of scurvy by fresh fruit or vitamin C – until the introduction of double-blind tests in the twentieth century.

Clinicians have probably always intuitively known that patients' desire to please, combined with the doctor being in a position of authority, i.e., as someone who is supposed to know, had a curative effect. To be an authority you do not necessarily have to know what you are talking about or know what you are doing. The history of medicine has made this abundantly clear. What is vital, however, is that the patient *supposes* that the doctor knows. Supposition of

knowledge gives authority and such authority has an impact. In Jacques Lacan's work, the Other is written with a capital O when in the position as someone who is *supposed* to know – the doctor, the teacher (Lacan, 1998).

Freud employs the concept of transference to refer to the repetition of infantile relations; i.e., we repeat by transferring the emotional matrix – loving and hateful, tender and aggressive – and unconscious conflicts with parents and siblings to future relations (Freud, 1968). Freud describes the connection between transference as a condition of possibility for clinical practice *and* for being within educational reach.

In so far as his transference bears a 'plus' sign, it clothes the doctor with authority and is transformed into belief in his communications and explanations. In the absence of such a transference, or if it is a negative one, the patient would never even give a hearing to the doctor and his arguments. In this his belief is repeating the story of its own development; it is a derivative of love and, to start with, needed no arguments. Only later did he allow them enough room to submit them to examination, provided they were brought forward by someone he loved. Without such supports, arguments carried no weight, and in most people's lives, they never do. Thus, in general, a man is only accessible from the intellectual side too, in so far as he is capable of a libidinal cathexis of objects; and we have good reason to recognize and to dread in the amount of his narcissism a barrier against the possibility of being influenced by even the best analytic technique (Freud, 1968, pp. 445-446).

What is important here is the patient's "belief" in the doctor's explanations, the patient being "capable of libidinal cathexis", and "narcissism" as a "barrier". Lacan highlights this "belief" by interpreting transference as love of *knowledge*, the Other's knowledge, rather than love of the other as a person - whatever is meant by the concept of person. Transference is a question of "a subject who is supposed to know" (Lacan, 1998, p. 230). *Supposition* of knowledge is what is transferred and what counts. To reiterate, supposition of knowledge makes the doctor a figure of authority, into the Other for the subject. Furthermore, and transferred to an educational setting, when transference is love of knowledge, the Other's knowledge, the student does not actually know whether the teacher knows; it is an assumption, a supposition and the precondition for listening, for paying attention. The students' supposition may prove mistaken, the teacher may not be up to the task, but disappointment presupposes an initial supposition of knowledge.

### **Unconscious Knowledge**

The concept of placebo is arguably as close as medicine gets to acknowledging the psychoanalytic concept of the unconscious and unconscious knowledge. In psychoanalysis, the concept of the unconscious does not only refer to a lack of consciousness – whatever is meant by the concept of consciousness. The unconscious needs the dynamic aspect of repression (Freud, 1964). This combination of the unconscious and the repressed refers to knowledge that the ego – the specular image of a self – cannot recognize. Such knowledge is fundamentally knowledge

about how to enjoy; a forbidden and unacceptable satisfaction once enjoyed. The reason for the existence of the peculiar clinical practice of psychoanalysis is simple and well known: repressed unconscious thoughts return. Satisfaction once enjoyed returns in distorted, barely recognizable ways. Analysis is necessary in order to recognize such repetition. The return of the repressed refers to an acting out of unconscious knowledge.

Knowledge and acting are intertwined in both psychoanalysis and RCT. When the researcher is kept in the dark regarding the content of the drug he or she is administering, the reason is also that knowledge can distort his or her interpretation of the effects of the treatment. The desire to get results may influence and distort the interpretation of data; wishful thinking can distort the interpretation of scientific data. Knowledge can thus pose an obstacle to scientific objectivity and clinical perspicacity. In other words, the double-blind procedure recognizes a limit to knowledge. As an aside, wise men have been known to be literally blind. In Sophocles' *Oedipus Rex*, the blind Teiresias predicts the destiny of no less a person than King Oedipus. A more contemporary textbook example is the effect of introducing blind auditions when recruiting new members to symphony orchestras. In the 1970s, a screen was introduced to conceal the identity of the candidate from the selection jury. In 1970, female musicians comprised less than 5 % of all players in the top five symphony orchestras in the United States, whereas today this figure is more than 25 % (Goldin & Rouse, 1997). Apparently, juries needed to be 'blinded' in order for their assessment to be unbiased, objective. Last but not least most scientific journals operate with the double-blind peer review policy in the editorial process.

When the trial is only blind rather than double-blind, the researcher deliberately represses his knowledge. This deliberate, conscious effort to repress knowledge is inadequate as far as the effects of unconscious desire are concerned. Double-blind trials are necessary because the return of repressed desire – failed repression – is more effective than intentional repression.

### **Knowledge as an Obstacle**

The idea of knowledge as a distorting factor is crucial to the clinical practice of psychoanalysis; the analyst's assumed knowledge, his preconceived assumptions pose an obstacle to listening. The analyst should maintain an "evenly suspended attention" (Freud, 1958, p. 111). To listen presupposes recognition of a lack of *and* desire for knowledge. When the doctor thinks he knows, he stops listening and he can proceed to make a diagnosis and prescribe a treatment. The reason for the peculiar practice of psychoanalysis – the client speaking, the analyst listening – is that the analysand ("psychanalysant", the *gerundival*, the one who should be analysed is supposed to know, not the analyst (Lacan, 1967, p. 247). However, the analysand cannot recognize this knowledge. The practical challenge for psychoanalysts is to maintain a position as someone who does *not* presume to know. This passive, listening position represents no less than a Copernican revolution as far as the doctor's position and the cure are concerned; this is the very precondition for being an analyst. Paradoxically, however, the analysand only addresses the

analyst because he supposes that the analyst possesses knowledge – knows why the subject is suffering, knows what he is doing. This is what the concept of transference refers to. The analyst has to frustrate this desire, evade this position, so as to be able to continue listening.

Strictly speaking, psychoanalysis has no other goal than to lift repression. Its goal is not normality, adaptation to reality, happiness or any other ideal that transcends analysis itself. This is a fundamental point in not only Lacanian psychoanalytic theory and clinical practice but also in Melanie Klein's theory and clinical practice (Klein, 1964; Millot, 1997). By 'strictly speaking' is meant that subjects undoubtedly address psychoanalysts because they are suffering and in the expectation that the psychoanalyst can alleviate this pain. But to achieve this goal the analyst must abstain from anything else than to analyse. Or as Freud famously put it "[...] much will be gained if we succeed in transforming your hysterical misery into common unhappiness" (Freud, 1973, p. 305).

### **Ego Ideals and Ideal Egos**

Repression prevents you from achieving this state of "common unhappiness", and agents of repression are any ideals, any norms – so called ego ideals (Freud, 1961) – of what you lack, of what you should be or of what you are not yet that prevent thoughts from entering into circulation. Ideals can consist in any image of normality, happiness, meaningful goals to pursue, any idea of the proper moral way of enjoying oneself, even the idea that you *should* enjoy yourself at all. An ideal is also any image of a reality to which one is supposed to adapt and of which the psychoanalyst is supposed to be a representative.

By virtue of the simple fact that the goal of analysis is to allow the analysand's repressed thoughts and knowledge to enter circulation the analyst must evade the position of representative of the *ideal ego*. Lacan distinguishes between the symbolic ego ideal and the imaginary ideal ego (Lacan, 2015). The latter is the analysand's imaginary projection – the Other is seen or imagined to be a representative of normality and reality, the Other as someone who is supposed to know how to enjoy properly. In contradistinction to this, Lacan states that the purpose of an analysis is to bring forth the *ego ideal*, which is a symbolic introjection that serves to repress desire; i.e., prevents thoughts from entering circulation. Symbolic introjection is not restricted to imagining that the Other possesses laudable qualities that your own poor ego lack, but the desire *to be* like the admired, loved Other. The subject identifies with a single trait of the Other, a trait that distinguishes the Other from others (Freud, 1962, Lacan, 1961). The subjective identification concerns the formation of the ego, the specular image of a self. There is no ego without the Other, neither in Freud nor in Lacan (Freud, 1962). The ego is both an imaginary, narcissistic formation and, thanks to the symbolic ego ideal, the agent of repression. In this sense, clinical analytical practice cannot, according to Lacan, be therapeutic as it is impossible to pinpoint the goal in any other way than as the production of analysts.

## The Antinomic Relation between Psychoanalysis and Pedagogy

If the analyst, even temporarily, becomes a representative of pedagogical, educational norms, if he or she becomes a representative of the symbolic ego ideal, he or she becomes the agent of repression. In Catherine Millot's seminal book *Freud antipédagogue* (1997) – which, unfortunately, has not been translated into English – she argues that psychoanalytical and pedagogical practices are “antinomic”. Millot bases her contention not only on Lacan's work but also in particular on Melanie Klein's explicit position in connection with the question of the possibility of child analysis). In fact, Melanie Klein was a champion of the “radical antinomy between a pedagogical and a psychoanalytic orientation” (Millot, 1997, pp. 198-199).

Millot bases her argument on an exposition of the difference between the respective approaches of Anna Freud and Melanie Klein to the question whether psychoanalysis can serve to achieve a pedagogical goal. Anna Freud's position is, with many reservations that it can. Melanie Klein, meanwhile, denies this possibility: If the analyst, even temporarily, becomes a representative of pedagogical, educational norms, he or she becomes the agent of repression and has missed the opportunity to analyse. In order to succeed, a psychoanalyst working with children must have the same approach like an analyst of adults; the psychoanalyst must be willing *only to analyse* (Klein, 1964).

Two statements are said to be antinomic if they are contradictory, yet both obtained by correct reasoning. To call the relation between pedagogics and psychoanalysis antinomic implies that psychoanalysis and pedagogics are mutually exclusive, that they can neither contribute to nor correct each other and that they cannot outdo or replace each other. Millot argues that, if what goes on in the analytical practice is normative, educational, ‘the cure’, i.e., analysis becomes impossible and conversely, psychoanalysis can contribute to educational practice with nothing more than banalities not to encourage repression by being too strict, by forcing your own imaginary ideal ego upon the child etc.

Taking this into account, how can the relation between psychoanalysis and pedagogics be of any interest? The answer is that the antinomy between pedagogics and psychoanalysis can clarify what is unique about both psychoanalytic, clinical practice and pedagogical, educational practice. In other words, only if one understands why psychoanalysis cannot be pedagogical or educational, can one understand why *analysis* in psychoanalytical practice is different from therapy. Normative, therapeutic, educational psychoanalysis is no longer psychoanalysis. According to Millot, this implies that one person cannot be both pedagogue or teacher *and* analyst for someone else. As professional positions, they are mutually exclusive. This is what is meant by psychoanalytic and educational practice being antinomic practices.

The psychoanalyst must work in order to lift transference, and in order to achieve this goal, he or she cannot represent ideals because ideals serve repression. By contrast, any upbringing or educational practice must necessarily entail some kind of representation of a future ideal. Repression of the immediate satisfaction of drives serves this purpose. Upbringing and education

necessarily repress drives, according to Freud – hence the title of Millot’s book *Freud antipédagogue*. When Millot describes Freud’s analytic practice as being anti-pedagogical, Freud was obviously not *against* the pedagogical in the sense that you should not help the child to repress its drives in order to adapt to reality. On the contrary, he was against analysis turning into adaptation to reality, against the psychoanalyst representing an ideal of what is reality to which one should adapt.

The fundamental contention of psychoanalysis is, as Millot formulates it, that we no more control the effect we have on others than we control our own unconscious. No teacher controls the impact he or she has on the student. How do empirical research projects within the educational field take this into account? Or rather, why don’t they, seeing as it is standard procedure to do so in the medical sciences?

Could the answer that simple, namely that the concept of transference (and placebo) refers to semi-automatic unconscious mechanisms that nobody in the educational relation – qua unconscious – can control, and if they are uncontrollable, it is tempting to ignore them, deny them existence? If so, it raises the question: Why, when medical sciences do not ignore such mechanisms, have educational sciences not developed procedures to contain this effect? Is it simply because educational sciences – given their subject matter – have no methods to do so, and therefore it is ignored? How could an educational research design be developed equivalent to double-blind medical trials? Again, if it is not possible, empirical researchers should at least recognize this explicitly, then revisit and perhaps even revise their ideals for good research.

### **Teacher Expectations. John Hattie**

In order to avoid making this critique abstract, even gratuitous, the focus in the following will be on John Hattie’s approach in his *Visible Learning* from 2009 and *The Purposes of Education. A Conversation Between John Hattie and Steen Nepper Larsen* from 2020.

John Hattie has been singled out because of his reference to medical sciences as an ideal and because he is highly influential in relation to educational research and policymaking, at least in the Scandinavian countries. Proponents of RCT as a gold standard often refer to Hattie’s work as an ideal and as an authority as far as policymaking is concerned. However, as early as the fourth page in *Visible Learning*, Hattie points out that.

There are few such studies among the many outlined in this book, although it could be claimed that there are many “evidence-informed” arguments in this book (Hattie, 2009, p. 4).

Relevant to this article’s theme, Hattie, whose motto is “Know thy impact”, points out that teachers’ (lack of) expectations are vital in terms of the effects of teaching. He claims: “My point is that teachers’ beliefs and commitments are the greatest influence on student achievement *over which we can have some control* [...]” (Hattie, 2012, p. 22).

I have no reason to dispute Hattie’s hypothesis as such. But how much is “some” control?

Do we control 90 % or just 10 %, the tip of the proverbial iceberg? Or some number in between? This question ought to be of 'some' importance. Educational sciences that conduct quantitative studies should be able to offer empirical answers. Otherwise, they are founded on a speculative hypothesis just like any other scientific approach.

How do you control the variable of teacher enthusiasm when involved in an exciting new research project under professorial supervision? How does this *not* have an effect of suggestion so the effect disappears when it is no longer a trial but a so-called evidence-based method forced upon teachers? And how does the researcher prevent his enthusiastic expectations from tainting the interpretation of data? In social sciences, this is called the "Hawthorne-effect" (Hattie, 2009). Hattie, in his defence, mentions that the mere introduction of a new method creates enhanced attention and thus makes a difference. In other words, the method in itself does not necessarily make a difference; rather, it is the simple fact that it is new. What works is the teacher's attentiveness to feedback, and this attentiveness is augmented just by doing something different than what you usually do. It is not the method in itself that makes the difference but the break with existing ways of doing things. Hence, it could be claimed that what works is simply not sticking to the same old routine for too long. However, this is not Hattie's message. Against "one of the most enduring messages [...] that 'everything seems to work'" (Hattie, 2009, p. 1) and that "one only needs a pulse" (Hattie, 2009, p. 16), his meta-analysis is intended to provide "a method to evaluate the relative efficacy of different influences that teachers use" (Hattie, 2009, p. 6).

The caution that psychoanalysis recommends is simple: you should be careful not to be seduced into thinking that it is the method that can claim merit for the effect. And to this question Hattie clarifies: "We are not interested in how teachers teach, but the impact on students" (Hattie & Larsen, 2020, p. 62). He further clarifies that this is also his position as far as scientific methods are concerned, especially the Randomized Controlled Trials. It is even "[a] major, major mistake when you privilege a method as the gold standard" (Hattie & Larsen, 2020, p. 64).

This problem – of showing which method is more effectual – is also well known in relation to therapeutic methods, be it psychoanalytic-psychodynamic therapy, cognitive therapy, mindfulness etc. Among psychotherapist it is far from uncommon to argue that it is not the theoretical and methodical background that does the difference but the very relationship between therapist and client. Cognitive, behavioural therapy once claimed to be faster and more efficient than the time-consuming and expensive psychoanalytic-psychodynamic method. However, the argument against this triumphant superiority was also simple: Cognitive therapy may be more effectual on a short-term basis – the clients claim that they feel better, existence is less painful, they cope better in their work relations and personal relationships – but the effect is not long-lasting.

To avoid misunderstandings, my argument is not that psychoanalysis as a clinical practice is more effectual than any other clinical practice. Nor is my argument that it is less effectual. In fact, my argument is that psychoanalysis strictly speaking is not therapeutic because it aims *only*

to analyse. And this is the basis for the relevance of psychoanalysis in the debate concerning the efficacy of didactical methods.

### **The History of Educational Methods as a History of Transference**

If the history of medicine can be described as the history of placebo (Shapiro & Shapiro, 1997), it seems obvious that the history of educational methods be described as a history of transference. The peculiar fact is that, to a much larger extent than educational sciences, medical sciences acknowledge that the unconscious is also effectual in relations between people. The difference is that psychoanalysis claims that what is truly effectual is unconscious. This unconscious dimension that no one controls is at play, for better and for worse, when you educate and when you cure.

I deliberately write ‘for better and for worse’ because psychoanalysis describes drives that have a considerable positive effect on the cure and on education; in short, on the formation of human culture (Freud, 1955, p. 190). This description of uncontrollable unconscious mechanisms can only be considered a source of disillusionment if the assumption is that the lack of conscious, intentional control over the effect we undoubtedly have on each other is always ‘for worse’.

The criticism that can be levelled against those educational sciences that posit medical sciences as an ideal does not address the scientific ideal as such. Rather, it contends that this scientific approach cannot match its own ideal.

### **Transference and the Object of Education**

Education implies a relation between student(s) and teacher(s). Teaching and learning imply social bonds. This is not just a triviality. Arguably, education is at play in any kind of social bond, but if we do not consider social bonds in general but rather the specific institutionalized social bonds called schools and universities as representing something different from what goes on in sports clubs, at workplaces, and in families, what are the formal conditions of teaching?

The relation between teacher and student concerns a so-called subject matter. The relation is about some *thing*. It is not always altogether clear what this *thing* is, what is the matter, or why the teacher is concerned about it, but teaching needs this reference to something outside the teacher-student relationship in order to be called teaching. In other words, it is not enough to speak about relational competences or learning to learn. Teaching is a relation because we teach a subject *matter* and we learn because we learn some *thing*. To repeat, what the *matter* is and what the *thing* is are not entirely clear. I will return to this.

Now, students are not supposed to know; they are supposed to be lectured. This is the fundamental reason why they sit in the classroom. The teacher is supposed to know. Transference refers to this indispensable *and* quasi-automatic mechanism.

To repeat, in order to learn you need to be able to love, to what Freud designated as

libidinal cathexis of objects (Freud, 1968). You need to *suppose* that the other knows (Lacan, 1998). Not everybody is capable of loving, not everybody is capable of this supposition. This is exactly the trouble with the kind of narcissism that Freud “dreaded” as “a barrier against the possibility of being influenced by even the best analytic technique” (Freud, 1968, pp. 445-446.) The investment of libido in the ego – the specular image of oneself, rather than an external object or an Other – can keep us in ignorance, can prevent us from thinking. Students discuss with teachers; they may challenge, even fight the teacher *provided* they suppose that he or she knows what he or she is talking about. Otherwise the teacher is simply irrelevant.

Not all students consider their teacher relevant, and transference is not only love of knowledge. Students may also hate their teacher. If you hate someone, according to Lacan, you ‘de-suppose’ him or her of possessing knowledge: He or she does not know the first thing about the subject matter; he or she does not possess knowledge. You do not respect the Other *as* Other when you hate or despise him or her. The teacher is a waste of time; he or she is comparable to waste.

When this is the case, you, as a teacher, often stand powerless. This does not present a major practical problem at universities; students simply stop turning up. It is, however, a major problem in high schools and any other school where attendance is compulsory.

This could be one of the reasons why even seasoned teachers may enter a new classroom or auditorium with a certain degree of trepidation. We do not often talk about it for obvious reasons: there is nothing to do about it. There are no guaranteed methods, no tricks of the trade to ensure the desired outcome because it has to do with the fundamental vulnerability when confronted with the desire of the Other – here, the students. Or to be more precise, it concerns the Other as subject. In Lacan’s work, the concept of the subject does not signify foundation, but what escapes being conceived of as an object of knowledge. The Other as subject is what potentially shatters the fragile narcissistic specular image of yourself as a competent teacher.

Lacanian psychoanalysis distinguishes between drive and desire, which may help to clarify Freud’s concept of transference (Lacan 1998). When transference is both a question of drive (libidinal cathexis of objects) and of desire (of the Other), the question of the Other’s *object*, is introduced. What am ‘I’, if anything, to the Other *and*, more importantly, what is the Other’s object at all, what is the teacher so concerned about and why? This question of the Other’s object is vital for teaching. In order for this question to be raised, transference needs to be at play. Transference *is* this question. No matter how goal oriented our teaching is, no matter how much we try to make explicit what it is the students are going to learn and why, from the students’ point of view it is a question, a question of what is the object of the teacher’s desire. And seen from the teacher’s point of view, precisely what the students learn is beyond one’s control, no matter how ‘learning outcome oriented’ one’s method might be and no matter how much one might desire to ‘know one’s impact’.

## Who is Responsible?

Nobody controls the effect he or she has on others; the unconscious is not transparent to anyone. But what are the implications of this for educational practice? What teachers can learn from analysts is the importance of how you position yourself when you are the object of transference. How do you *not* pose an obstacle to the students' working and thinking?

It should in no way be inferred that the teacher can disavow responsibility. The basic point is that the teacher – like the analyst – is always responsible when he or she fails. As far as the question of responsibility is concerned, the psychoanalytic practice and the educational practice are *not* antinomic. In fact, psychoanalytic ethics can serve as an inspiration: the analyst is always responsible for the clinical work. If an analysis terminates prematurely or comes to a standstill, the analyst cannot excuse him- or herself by blaming the analysand. It is not the analysand who is so-called impossible; it is the control of resistance to the analytic work that has failed. After all, resistance to lifting repression is the very reason why analysts are needed, the reason for the impossibility of self-analysis. Analogously, a teacher cannot blame the pupil or student, saying he is lazy, not serious, does not work hard enough. The inspiration gained from analysis is that the analyst, the teacher, the boss are always responsible when work cannot be done – be it clinical, analytical, schoolwork, or any other kind of work. In other words, the ethical implications of psychoanalysis are absolutist. There is simply no room for the blame game neither in psychoanalysis nor in education.

## In Conclusion: The Use of Psychoanalysis in Educational Sciences

To what use is a theory that has developed concepts for analysing why we cannot control the influence that we undoubtedly have on each other? The concept of unconscious transference implies that neither educational failure nor success for that matter can nor should, solely, be ascribed to didactic methods. Psychoanalysis as a theory offers concepts that provide an opportunity to reflect upon and analyse in which way unconscious dynamic processes between pupil and teacher effect the outcome – for better and for worse. It offers concepts that provide an opportunity for the teacher to reflect upon how he or she positions him- or herself towards the pupil. This might not be useful in any immediate demonstrable sense.

Psychoanalysis offers concepts for analysing why we want to 'please' (cf. 'the placebo'), why we want to live up to the expectations of the Other, and why anxiety concerning the loss of the Other's love and recognition is a powerful drive or incentive to learn to such an extent that teaching methods are of only minor importance. If the legitimacy of theories needs or even demands reference to utility, the answer might be that it is useful to be acquainted with psychoanalytic theory and concepts in order to avoid being too easily seduced by over-confidence in scientific and didactic methods. There are conditions for educational practice, indeed probably the most important conditions that evade methodical, didactic control.

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## About the author

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# **STUDENTS' MENTAL HEALTH, STRESS, ACADEMIC ANXIETY AND KNOWLEDGE OF COVID-19 AMONG HIGHER EDUCATION STUDENTS**

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## **Abstract**

COVID-19 is a wide-reaching health emergency which makes the globe to a standstill with supreme and unexpected impact in our life. The present study is focused on the mental health, stress and academic anxiety among students of higher education. This study was conducted to know the level of mental health stress and academic anxiety of the higher education students during this pandemic virus period. The sample consists of 883 various higher education students from all over Tamil Nadu, India. An online survey was conducted using a questionnaire, and snowball sampling technique has been used for the selection of sample. The data were analysed using a 't' test and percentile of the response. The major findings of the study revealed that there is a significant difference in the Covid-19 crisis knowledge and adaptations of the pandemic situation of the higher education students of India with respect to sex, course of studying, discipline within its higher education institutions.

**Keywords:** mental health, stress, academic anxiety, higher education, pandemic

## **Introduction**

COVID-19 was reported practically at every corner of the planet and has affected millions of people. Though the infection originated from China, the worst affected country was America, which was followed by Spain, Italy, Germany and France. The World Health Organization (WHO) declared the 2019–20 corona virus outbreaks a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 and a pandemic on 11 March 2020. The evidence of local transmission of the disease have been found in many countries across all six WHO regions and most of the countries have announced an emergency alert throughout their countries. The control of the COVID-19 spread has been very difficult as half of the patients kept spreading the virus even after resolution of their symptoms. During this situation, students are in need of support and alternative educational resources to continue their studies. Advice and proceedings from the Ministry of Human Resource Development (MHRD) and University Grants Commission (UGC) have given various favourable alternatives to the state government. The corona virus spread to the world widely from December 2019 onwards. Since it spreads hastily around the globe, the WHO has acknowledged the COVID-19 a pandemic. Due to a lack of knowledge awareness about the

symptoms and preventive measures of COVID-19 more people have been affected and admitted to hospitals. Most of the older people and those who are under treatment are at higher risk of illness.

As COVID-19 has become more widespread, it has left millions of students affected in their studies. Schools, colleges, and universities have shut down. Millions of students seem to be psychologically worried about their career and their further studies. Governments around the country are reacting in varying degrees to the crisis. Teacher educators try to guide younger generations through this pandemic by giving correct directions, giving support and guidance to their students like awareness about Covid-19, and ways to face the mental health, stress, and anxiety in this period.

The students still seem mentally distressed about their further studies and may have developed academic anxiety about future academic outcomes. The present study attempted to shed light on the students' knowledge of COVID-19, their mental health, stress, and academic anxiety among the higher education students of all over Tamil Nadu.

### **Need for the Study**

India, being a large and densely populated country, implemented preventive measures to curb the spread of the disease COVID-19 which includes closing of schools/educational institutions and other nonessential facilities. India has the second-largest education system in the world after China. Different sectors, including the education sector, have seen a setback due to the COVID-19 being on the rise. The lives of every individual in the country seems to have been largely affected. As every individual's life is being affected, the life of a student is no less of concern. At this time of crisis, it becomes challenging to keep their education continuous and unaffected due to this disastrous pandemic. There needs to be a system where there is togetherness between the students and teachers without actually being face-to-face.

The corona virus issue has thrown challenges all over the world as seen by those struggling for economic, education, and day-to-day needs. The student community was directly affected all over the country and it is unknown at the writing of this paper about the further scope of higher studies. The students from school level to higher education level were waiting for solutions to be found for their year-end exams. The outbreak of this dreadful corona virus may bring students distress and have a severe impact on their mental health, stress, and anxiety. It is believed that the higher education students should acquire basic knowledge about COVID-19 and preventive measures against it. Physical health, physical distancing and hygiene are some of the important solutions in this scenario to get relief from stress about this situation. The central government, state government authorities, and policymakers are defining solutions and remedy from this pandemic situation and provide solutions to the education sector.

UGC provides guidance and clarifications to the government to formulate action plans for effective adaptation without affecting the carrier and studies of the students. End term

examinations, entrance examinations and admissions to the higher studies are the immediate concerns. UGC suggested to conduct multiple-choice question based examination which is easy to conduct, evaluate and declare the results by taking the specificities of the different courses into account. UGC also suggested using an online model for teaching and learning. Here the stress and academic anxiety started in the minds of the students since most of the students belong to poor and weaker sections of the society that do not have accommodations for the intensive online requirements needed. The families, homes, neighborhoods and localities are not suited to facilitate learning through online modes because it is not possible to have smart phones, laptops, personal computers, workable broadband connections. Secondly, there is concern about the ability and willingness of the faculty to adopt online modes since they are accustomed to old methods of teaching.

Another critical issue is the availability of libraries which are very important in higher education institutions. The majority of students rely upon the library to prepare for competitive examinations and to secure stable employment. Even now, as this paper is being written, the educational institutions are closed beginning from March 2020 in India. In this present study, the investigator studied the knowledge of COVID-19 precautions, mental health, stress, and anxiety among the students of higher education in Tamilnadu. The findings will help the educationalists and the government to take remedy during the outbreak and commence counseling and guidance for further actions.

### **Objectives of the Study**

The present study has the following objectives:

1. To study the knowledge of COVID-19 precautions, mental health, stress and academic anxiety among higher education students of Tamil Nadu - India.
2. To determine if there is significant difference in the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu – India based on their a) gender b) course of study c) type of institutions and d) discipline

### **Delimitations of the Study**

The present study has the following delimitations;

1. The investigators selected only 883 students in Tamil Nadu, for the study.
2. The investigator selected samples only from Tamil Nadu.
3. The survey was collected through internet access only.

## Hypothesis

1. There is significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu with respect to gender (a) male (b) female.
2. There is significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu with respect to a) Under Graduate b) Post Graduate c) Research Scholar
3. There is significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu based on students' a) discipline b) higher educational institutional level.

## Methodology

### *Population of the Study*

The investigator used a cross sectional survey which was conducted between 5<sup>th</sup> May 2020 and 12<sup>th</sup> June 2020. Since the data were collected during the lockdown period from all over Tamil Nadu – India, higher education students are used in the study.

### *Sample and Sampling Technique*

The investigator used a cross sectional survey which was conducted between 5<sup>th</sup> May 2020 and 12<sup>th</sup> June 2020. Since the data were collected from higher education students during the lockdown period from all over Tamil Nadu, a snow- ball technique, which is a type of non-probability sampling technique, was used to collect the responses from the participants. A sample of 883 people of Tamil Nadu participated.

### *Data Collection*

For the data collection, the investigator conducted an online survey which contains a questionnaire regarding knowledge on COVID-19 precautions, mental health issues, stress and academic anxiety was sent out to higher education students. An online questionnaire was developed by using Google forms. Participants willingly participated in the study and were thus considered excused from written informed consent. The questionnaire contains four parts. In the first part the demographic variables such as gender, course studying, discipline, type of the agency/institution were incorporated. The second, third and fourth part contains 30 questions to measure the knowledge on COVID-19 precautions, mental health issues, stress and academic anxiety. Knowledge on COVID-19 precautions, mental health questions assigned 4 choices and academic anxiety assigned Yes/No type questions.

### Statistical Analysis

After collecting the data, data entry and statistical analysis was performed with the statistical package for SPSS program for windows (Version-23). Descriptive statistics, such as percentages, means, and standard deviations were calculated. T.-Test and ANOVA were used to analyze the dependent (knowledge, mental health, stress and academic anxiety), and independent variables (demographic characteristics of the participants). Statistical significance was considered at P value of less than 0.05 for all analyses.

### Analysis of the Data

**Table 1**

*Mean score of knowledge on COVID-19 precautions, mental health issues and academic anxiety by higher education students of Tamil Nadu.*

| N (number of Students) | Mean score |
|------------------------|------------|
| 883                    | 19.41      |

The above table 1 shows the mean score of knowledge on COVID-19 precautions, mental health issues and academic anxiety towards higher education students of Tamil Nadu. The mean value (19.41) is nearer than the mid value (20.00) however, the difference is significant and hence, higher education students of Tamil Nadu have average score of the knowledge on COVID-19 precautions, mental health issues and academic anxiety.

**Hypothesis 1:** There is significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu with respect to (a) male (b) female.

**Table 2**

*A significant difference between the knowledge of COVID-19, mental health, stress and academic anxiety among higher education students of Tamil Nadu with respect to (a) male (b) female.*

| Variables | Categories | N   | Mean  | SD    | t-Value | Level of Significance |
|-----------|------------|-----|-------|-------|---------|-----------------------|
| Gender    | Male       | 328 | 19.43 | 3.271 | 0.158   | NS                    |
|           | Female     | 555 | 19.40 | 3.199 |         |                       |

Note. Significance at 0.05 level

Table 2 shows that the calculated value of 't' (0.158) is lesser than the table value (1.98) at 0.05 significant level with respect to gender and thus there is no significant difference in the knowledge of COVID-19 precautions, mental health, stress and academic anxiety among higher education students of Tamil Nadu. With respect to gender and hence it is to reject the hypothesis

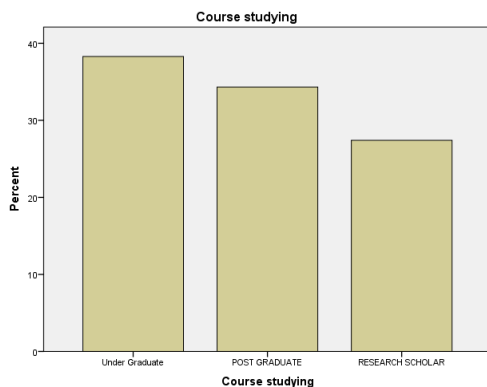
1.

**Hypothesis 2:** There is significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu with respect the course of study.

**Table 3**

*A significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu with respect to the course of study.*

**Figure 1.** Course Studying by graduate levels



**Table 3** shows higher education students of Tamil Nadu with respect to the course of study

|                | Sum of Squares | df  | Mean Square | F- Value | Sig.   | Result |
|----------------|----------------|-----|-------------|----------|--------|--------|
| Between Groups | 280.363        | 2   | 140.183     | 3.0059   | 0.000* | NS     |
| Within Groups  | 8888.269       | 880 | 10.100      |          |        |        |
| Total          | 9168.632       | 882 |             |          |        |        |

Note. Significance at 0.05 level

Table 3 shows that the calculated value of 'F' (3.0059) are lesser than the table value (3.0) at 0.05 levels with respect to the course of the study, hence the formulate hypothesis-2 is rejected and thus there is no significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students (Under graduate, Post graduate and Research scholar) of Tamil Nadu with respect the course of study.

**Hypothesis 3:** There is significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu based on their a) discipline b) educational institutional types.

**Figure 2.** Higher education students of Tamil Nadu with respect to the course discipline

| Discipline |                             |           |         |               |                    |
|------------|-----------------------------|-----------|---------|---------------|--------------------|
|            |                             | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid      | Arts                        | 422       | 47.8    | 47.8          | 47.8               |
|            | Sciences                    | 313       | 35.4    | 35.4          | 83.2               |
|            | Engineering                 | 50        | 5.7     | 5.7           | 88.9               |
|            | Medical                     | 13        | 1.5     | 1.5           | 90.4               |
|            | Technical (ITI/<br>Diploma) | 8         | .9      | .9            | 91.3               |
|            | Social sciences             | 77        | 8.7     | 8.7           | 100.0              |
|            | Total                       | 883       | 100.0   | 100.0         |                    |

A significant difference between the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety among higher education students of Tamil Nadu based on their discipline and educational institutional types.

**Table 4**

Discipline and Educational Institutional Types

| Variable                        | Source of variance | Sum of Squares | DF  | Mean Square | F- Value | Sig.   | Result |
|---------------------------------|--------------------|----------------|-----|-------------|----------|--------|--------|
| Discipline                      | Between Groups     | 228.063        | 5   | 45.613      | 2.2243   | 0.000* | NS     |
|                                 | Within Groups      | 8940.561       | 877 | 10.194      |          |        |        |
|                                 | Total              | 9168.632       | 882 |             |          |        |        |
| Educational Institutional Types | Between Groups     | 228.063        | 5   | 45.613      | 0.0255   | 0.000* | NS     |
|                                 | Within Groups      | 8940.569       | 877 | 10.194      |          |        |        |
|                                 | Total              | 9168.632       | 882 |             |          |        |        |

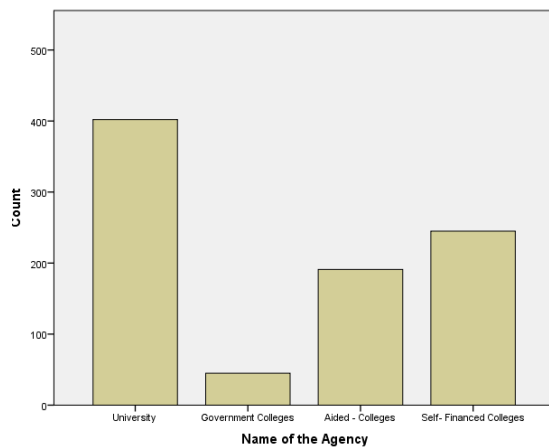
Table 4 shows that the calculated value of 'F' (2.2243, 0.0255) is less than the table value (3.0) at 0.05 level with respect to the discipline and Educational institutions types respectively, hence the formulate hypothesis-3 is rejected and thus there is no significant difference between the knowledge of COVID-19,

mental health, stress and academic anxiety among higher education students of Tamil Nadu with respect the course of study and Educational institutional types.

**Figure 3.** Higher education students of Tamil Nadu with respect to the institutions type

| Name of the Agency      |            |              |               |                    |
|-------------------------|------------|--------------|---------------|--------------------|
|                         | Frequency  | Percent      | Valid Percent | Cumulative Percent |
| University              | 402        | 45.5         | 45.5          | 45.5               |
| Government Colleges     | 45         | 5.1          | 5.1           | 50.6               |
| Aided - Colleges        | 191        | 21.6         | 21.6          | 72.3               |
| Self- Financed Colleges | 245        | 27.7         | 27.7          | 100.0              |
| Total                   | <b>883</b> | <b>100.0</b> | <b>100.0</b>  |                    |

**Figure 4.** Names of the Agencies



## Findings

1. The higher education students have attitudes towards their knowledge, mental health, stress and academic anxiety in the period of pandemic situation of COVID-19.
2. There is no significant difference between the mean scores of male and female higher education students' attitudes towards their knowledge, mental health, stress and academic anxiety.
3. There is no significant difference between the mean scores of higher education students' attitude towards their knowledge, mental health, stress and academic anxiety.
4. There is no significant difference among the mean scores of UG, PG and Research scholars' educational qualification of students' attitude towards their knowledge, mental health, stress and academic anxiety.

## Discussion

From the present study, it is clear that the higher education students have positive knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety in Tami Nadu. The study also reveals that the means scores of social science discipline students (20.57) have more knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety in Tami Nadu. Generally, all higher education students have enough knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety in Tami Nadu because of continuous awareness given from the university and central and state government.

The study also reveals that the male and female higher education students do not differ much in their knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety. The gender difference shows that the male and female both are of similar variation in their knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety.

During the COVID-19 pandemic period all over the world students' academic activities are paused. Final year students are fearful about their future careers and higher educational studies. Therefore, this situation has had an impact by showing some anxiety for the final year higher education students.

In this study, there is no difference between Arts and Science stream students in their attitude towards their knowledge, mental health, stress and academic anxiety. Hence, higher education students have high positive attitude towards their knowledge, mental health, stress and academic anxiety.

The study also shows that there is no significant difference among UG, PG and Research scholars' attitudes towards their knowledge, mental health, stress and academic anxiety. As a whole, if we look into the study, we can conclude that irrespective of gender, course of study, discipline and educational institutions, the students overall show a positive attitude towards their knowledge, mental health, stress and academic anxiety as the only means of combating the COVID-19 Crisis. This reveals that so far the students are having positive attitudes towards their knowledge, mental health, stress and academic anxiety. With the help of all these statements, the investigator could extract the similar attitudes of students towards their knowledge of precautions, mental health issues, stress and academic anxiety.

## Educational Implications

This study has the following educational implications;

1. There may be a need to promote awareness about the knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety to parents and other paraprofessionals.
2. There should be proper funding from the administration to meet the requirements of COVID protocols and precautions.

3. Measures should be taken to not adversely affect the state of higher education.
4. The importance of safety of students and quality of education imparted to them should rank the highest among priority for meeting the needs of higher education students.
5. There should be more efforts to educate the students by having the recovered persons share their experiences with others about treatments and quarantine.
6. To educate the population that they need not avoid the recovered persons and their families and to ensure that every recovering person follow the treatment protocol.
7. Make students aware of prevention protocols of the pandemic through the help of social media.

## Conclusion

For stress and academic anxiety to be maintained during the pandemic, it is essential that teachers, parents and other paraprofessionals maintain a positive attitude towards their knowledge of COVID-19 precautions, mental health issues, stress and academic anxiety. With the changing guidelines of the governments and the dynamic of inclusion of academic support, bringing students to a greater knowledge of the virus, maintenance of mental health, controlling stress and academic anxiety, then students can come back to a normalcy of their future. At this time of crisis, to overcome the challenges in keeping the education continuous and unaffected in this disastrous pandemic, there has to be a system where there is togetherness between the students and teachers without actually being face-to-face.

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# IMPACT OF CLASSROOM WELLBEING ON STUDENT LEARNING: BHUTANESE STUDENTS' PERCEPTIONS

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## Abstract

This qualitative research explored students' perceptions of classroom wellbeing and examined its impact on student learning. Participants consisted of twelve students from Samtse College of Education, selected using a purposive sampling technique. The data points were semi-structured interviews and classroom observations and were analysed using a thematic approach. The study's findings revealed that classroom wellbeing plays a significant role in enhancing student learning and confirm that various educational elements directly exert an influence on students' wellbeing and their learning.

**Keywords:** classroom wellbeing, student learning, student perception, interpersonal relationship, lecturer's competence, learning environment

## Introduction

Classroom wellbeing is a fundamental aspect of everyday teaching. Researchers across the world acknowledge the importance of classroom wellbeing (Putwain, 2019, Schonert-Reichl, 2017). McLeod and Wright (2015) claim that wellbeing has acquired currency and potency in education and noted that the call for addressing students' wellbeing is gaining attention and importance, leading to a rise in research in this important area (see Collings, 2014, González-Zamar, Ortiz Jiménez, Sánchez Ayala, & Abad-Segura, 2020).

Wellbeing is described generally as a state of mind in which individuals can realize their own abilities to respond to change, challenge and adversity. Classroom wellbeing encourages emotional security further creating conducive atmosphere for learning and emotional development (Bucholz & Sheffler, 2009, World Health Organization [WHO], 2004). In this study, we will follow our own definition of classroom wellbeing, namely, 'a classroom that empowers the learners and creates conducive and safe learning environment by ensuring transparent teaching, learning and assessment practices for the learners'.

The existing body of knowledge notes the importance of promoting wellbeing (González-Zamar, et al., 2020, Houghton, & Anderson, 2017). Recognizing the importance of and to promote classroom wellbeing in Bhutan, education policies emphasize the need to translate Gross National Happiness (GNH) principles and values including, among other elements, love, compassion, and

social responsibility in the teaching and learning process (Ministry of Education [MoE], 2009). Moreover, higher education colleges in Bhutan have been identified as a key institutional and relational settings for promoting adult learners' social and emotional wellbeing (MoE, 2019).

Aligning to MoE's initiatives and to materialize its goals, the Royal University Bhutan has established Happiness and Wellbeing centers in the colleges with the aim to enable self-empowerment, offer mentoring, academic guidance, career counseling and assistance to the individuals who are experiencing challenges in their social, emotional and academic lives (Samtse College of Education [SCE], 2020). However, despite such initiatives and with the increase in the wellbeing related research, there is still a persistent lack of clarity on how wellbeing is understood and addressed within the context of higher education (Goss, Cuddihy, & Michaud-Tomson, 2010). More specifically in Bhutan, there has been little evidence-based direction on how to systematically define, plan, and address effective wellbeing programmes particularly at a higher education level. Although a Happiness and Wellbeing centre has been established in SCE, owing to the lack of effective direction, lecturers and students in general are not able to handle and cope with classroom situations effectively neither they could translate GNH principles and values into classroom practices (Sherab, Maxwell & Cooksey, 2016).

### **Promotion of Student Wellbeing in Higher Education in Bhutan**

The Royal University of Bhutan was established to consolidate the management of higher education in Bhutan. It is an autonomous university with nine constituent colleges and two affiliated private colleges with a total of 9701 students and 357 teaching faculty. SCE is one of the two teacher preparation colleges with 831 students and 48 teaching faculty.

Inspired by the values and principles of GNH, lecturers can practice aspects of the four pillars of GNH (i.e. environmental conservation, socio-economic development, preservation and promotion of cultures and good governance) and the nine principles respectively (i.e. psychological wellbeing, health, education, time use, cultural diversity and resilience, good governance, community vitality and ecological diversity and resilience) in their classrooms that promote student wellbeing. GNH is an index used to measure the collective happiness and wellbeing of a population with wellbeing defined as the measure to empower the learner by creating safe learning environment. Although GNH and wellbeing are two different concepts, they are closely related and share the same purpose. Higher education in Bhutan is about translating teaching learning activities that embed GNH values and principles to promote classroom wellbeing. Therefore, it is imperative that higher education place their role in the larger context of students' wellbeing to find ways to transmit GNH principles and values to ensure optimum classroom wellbeing (MoE, 2019).

## **Understanding Classroom Wellbeing**

Although the concept of wellbeing is complex (Allardt, 1989) and poorly defined (McLeod & Wright, 2015), many terms describe aspects of classroom wellbeing, such as physical, psychological, cognitive, social and economic (Powell, Graham, Fitzgerald, Thomas & White, 2018). According to WHO (2004), wellbeing is described as a state of mind in which individuals are able to realize their own abilities, cope with the normal stresses of life, work productively and fruitfully and are able to make a contribution to their communities. Bucholz and Sheffler (2009) suggested that wellbeing in the classroom encourages emotional security, creating a conducive atmosphere for learning and emotional development. Further, Gilbert (2007) termed wellbeing as a psychological immune system, or cognitive ability to respond well to change, challenge, and adversity. Following the above ideas, in this study, classroom wellbeing was described as a classroom that empowers the learners and creates conducive and safe learning environment including transparent teaching, learning and assessment practices for the learners.

## **Relationship between Classroom Wellbeing and Student Learning**

Research indicates that a positive education can contribute to a higher sense of wellbeing (González-Zamar, et al., 2020, Putwain, 2019) and facilitate a classroom wellbeing that can lead to higher student achievement (Uline & Tschannen-Moran, 2008).

Likewise, previous studies showed that emotions are critical for student learning, quality of teaching and learning and as well as for wellbeing of both lecturers and students (Lincoln & Kearney, 2019). Associated with these ideas, research revealed factors such as interpersonal relationships among self, teachers, friends, and peers, impacts the teachers' and students' ability to handle classroom learning situations (Hattie, 2009; Powell et al, 2018; Roffery, 2012). When teachers failed to manage the social and emotional demands of teaching, damage could happen to students' self-image, academic achievement and behaviour (Marlowe & Page, 2005, Schonert-Reichl, 2017). However, classrooms with an atmosphere of mutual respect that allowed students to express themselves, supported deep learning and positive social and emotional development that were crucial for their wellbeing and learning (Potter, 2017, Stronge, 2018, Struthers, Perry, & Menec, 2000).

Marzano and Marzano (2003) asserted that behaviour and classroom wellbeing were two variables that potentially have the greatest impact on student learning, stating that teachers should develop effective classroom rules to manage behaviour and improve achievement. Supporting this idea, Pianta and La Paro (2003) reported that an optimal classroom environment was characterized by low levels of conflict and disruptive behaviour, smooth transitions from one type of activity to another, appropriate expressions of emotion, respectful communication and problem solving, strong interest and focus on task, and supportiveness and responsiveness to individual differences and students' needs. To develop and maintain healthy relationships with the students, lecturers must discover appropriate ways to express their feelings and assist students to express theirs in

classroom settings (Hargreaves, 2000). As one of the most significant adults in many students' lives, lecturers have a responsibility to establish practices that support the overall wellbeing of students and their learning (Janson & King, 2006). In sum, research stressed that for academic achievement, there is a direct link between teachers' approaches and student wellbeing (Van-Petegem, Aelteman, Rosseel, & Creemers, 2007).

Likewise, Putwain (2019) asserted that the physical conditions of a classroom exerted an influence on student wellbeing. Hammond (2004) also identified learning environments as a central component of students' overall experience that can impact not only their learning but also their personal wellbeing. Further, studies (Long, Ibrahim & Kowang, 2014; Matzler & Woessmann, 2010) indicated that lecturers' competencies in teaching, including subject knowledge, clarity of presentation and interaction with students are all positively correlated to students' satisfaction in terms of learning outcomes, which was directly related to students' achievement. Hence, the importance of lecturers' role in optimizing classroom wellbeing was brought to the forefront.

To conclude, a major finding from the literature is that wellbeing factors are crucial in enhancing student wellbeing (Pianta, La Paro, Payne, Cox, & Bradley, 2002). However, while the idea of promoting wellbeing is widely embraced, the means of implementing it has varied.

Given the initiatives and issues of education in Bhutan and the literature above, relatively little is known about the effects of classroom wellbeing on student learning in Bhutanese higher education. Therefore, there is a critical need for an empirical research to explore the impact of classroom wellbeing on student learning in the context of Bhutanese higher education institutions. A study on twelve students' perception of classroom wellbeing in relation to student learning was conducted at SCE with the aim to explore the impact of classroom wellbeing on student learning. We sought to answer the following research questions:

What are students' perceptions of classroom wellbeing in relation to student learning?

How does classroom wellbeing impact student learning?

## **Method**

### *Research Design and Data Collection Procedures*

The study was conducted using a qualitative phenomenological design guided by an interpretive paradigm. Qualitative phenomenology is appropriate for this study as it allows the researchers to study individuals' lived experiences (Creswell & Creswell, 2013), while the interpretive paradigm enables the researcher to seek people's interpretations, perceptions, meanings and understanding of a social phenomenon (Mason, 2018). These approaches proved useful for this study as it made us to explore the issue from the participants' point-of-view.

Semi-structured interviews and classroom observation were used to collect the data to

describe the impact of classroom wellbeing on student learning. Semi-structured interviews were the primary research tool used to solicit in-depth information about students' perception of classroom wellbeing. Twelve interviews, lasting between 30-45 minutes, were conducted to elicit each participant's experiences, feelings and convictions about the theme in question (Mason, 2018) (See Appendix A). Semi-structured interviews allowed the researchers to ensure that the relevant contexts were brought into focus so that situated knowledge could be constructed, reconstructed and produced (Mason, 2018). Further, five non-participatory classroom observations were also made before and after individual interviews. Non-participant observation allowed for gathering primary data on some aspects of social world without interacting directly with its participants (Williams, 2008), to gather 'live' data from naturally occurring social situation (Cohen, Manion & Morrison, 2007) and to record interpretations and judgements of the situations (Cohen et al., 2007). Data collection took place over a three-month period.

### *Research Context, Participants and Ethics*

The research was conducted at one of the constituent colleges of Royal University of Bhutan. The participants were undergraduate and postgraduate students consisting of six males and six females from SCE. Creswell and Creswell (2013), Mason (2018) and Guest, Bunce and Johnson (2006) suggest that a participant range between five to 20 is sufficient for a study such as this one. A purposive sampling strategy was employed to select the participants (Cohen et al., 2007). Consent was obtained, and pseudonyms were assigned. Approval for conducting this research was granted by the Office of the Dean of Research and Industrial Linkages.

### *Data Analysis*

Interview data were transcribed and analyzed manually using a thematic approach (Creswell, 2007). The interview data were read and coded. The codes were interpreted and described to form meanings of the original texts. The data for the current study was dense; therefore, winnowing patterns were generated (Flick, 2013). Guest, MacQueen and Namey (2012) posit that, when the data are rich, and cannot all be used, winnowing is essential for the study. To test the credibility of the analysis, the four researchers examined and coded the interview transcripts jointly to avoid misinterpretation of the data and accordingly, the apparent categories of the findings were identified. Further, the data from classroom observations and observation notes were triangulated with the interview data.

## **Results**

In conceptualizing classroom wellbeing and its relation to learning, the findings revealed a diverse range of factors that impacted students. These were categorised into six themes: 1)

lecturer competence; 2) physical environment; 3) classroom behaviour management; 4) interpersonal relationships; 5) instructional resources; and 6) classroom wellbeing.

### ***Lecturer Competence***

As in any classroom, the teacher needs to establish a learning environment that is effectively suited to learning. In this study, the students reported competence of a lecturer as a major source of classroom wellbeing, specifically, regarding lesson preparation and use of appropriate instructional methods and assessment tools. Students shared that most teachers came to class prepared, used various methods and appropriate assessments for diverse learners. Nine students directly conveyed that some lecturers included activity and assignment choices to encourage diversity. In the same vein, classroom observation data supported the idea that lecturers engaged students in the learning. For example, a tutor started the session by activating the students' prior knowledge, and initiated brainstorming and discussion exercises which were reported to be effective learning strategies by the students. One student summed up the concept of competence as follows:

As we are in a tertiary education, I feel that the competency of the tutor is very important. The main purpose of going to class is to gain some knowledge and if the tutor is not competent, there is no point going to the class. Then, it would be better for us to study on our own. So, I feel the lecturer competence is very important. (S1)

Although many participants agreed with the above statement, five students expressed their dissatisfaction about some lecturers' use of instructional strategies, pointing out that lecturers appeared to come unprepared and used a lot of PowerPoint slides which they found to be redundant. Moreover, these lecturers read the slides rather than explain the meaning of the material contained on them. These five students perceived that such teaching approaches have a negative impact on their wellbeing and learning. For example, S2 revealed:

Basically, most lecturers use PowerPoint and also, the same old PowerPoint, which affects our wellbeing and learning. They could use some other apps/technology that could make learning more exciting.

Supporting the appropriate use of more technology in instruction, half of the students expressed their inclination for technologically oriented, interactive or discovery-based lessons.

Another aspect of lecturer competence was teacher partiality. Several students voiced their discomfort and demotivation towards learning when the lecturer showed partiality. Students suggested that a small number of lecturers provided help and awarded good marks to students they favoured. For example, S3 said, "a small number of lecturers' award high grades to the ones they like, regardless of their performance especially in coursework". The same student also linked such bias to the teacher's recognition of students:

When they mark, I don't know what kind of idea they are using but I personally feel that

their mark is based on who they like. At times, I feel like knowing all the students in the class especially names have a negative impact on our wellbeing.

This statement indicated such attitude of the teachers negatively impacts the overall wellbeing of students which in turn affects their learning.

Students also reported that they experienced stress when lecturers assigned many assignments in an untimely manner, so that they were not able to meet academic deadlines, hence, leading to sleepless nights which hampered assignment quality. Students also stressed that some lecturers tended to assign independent learning activities without clear instructions or guidance. These issues, according to the S5, hinder classroom wellbeing and learning:

Without a clear guiding framework, it becomes difficult for us to proceed with those activities and hinders our learning outcomes. This type of situation, in fact, drains out our interest in learning and attending those classes.

Further, students added that some lecturers are hard to reach outside of class for help. However, students also reported that a small number of lecturers created opportunities for students to talk and express opinions.

Students also mentioned cultural aspects of social and emotional wellbeing and reported the importance of having lecturers they could trust and relate to. For example, four students claimed that they cannot learn well from lecturers who are ‘rude’ and ‘unapproachable’, attitudes that did not allow them to express their views and raise questions. In this way, they indicated their preference for lecturers who were open, supportive and approachable. Under such situations, students felt satisfied, stress-free, included, accepted, nurtured, supported, encouraged and motivated. Supporting these ideas, classroom observation data showed most of the class students opening up to lecturers who were encouraging and supportive. This finding indicated the importance of having supporting lecturers that students could connect with. Further, participants also pointed out that rewards, such as awarding marks for participation, made them want to participate more. This finding suggested that such lecturer qualities promote student wellbeing and, subsequently, better learning.

### ***Physical Environment***

All twelve participants identified and acknowledged the physical environment was consistently identified and acknowledged by students as an important aspect of classroom wellbeing. The same group of students expressed that “environmentally, we have comfortable classroom tables and chairs, setting is done in groups, which helps them learn from their peers and also lecturers.” This statement by S3 reflected the feelings expressed by the group regarding size of the classrooms, “I enjoy big classrooms which allows us to move around and talk to each other rather than just doing our individual work”. Although all participants stated that they generally have a good classroom setting, they recommended the need for air conditioning and a sound

system. However, the same group of students claimed that the sound of the fans interfered with the audibility of lecturers and created an unhealthy environment for the learning processes. The finding revealed that good physical environment has a crucial role in enhancing both classroom wellbeing and learning experiences while absence of such facilities negatively impacts their wellbeing.

### ***Classroom Behavior Management***

Students recognized behavior management as central to ensuring their wellbeing. The findings of this study show that all lecturers developed classroom rules to communicate expectations to students. However, the findings also implied that, at times, these rules were not executed effectively. Four students highlighted that some lecturers were not particular with the classroom rules. For example, a few lecturers showed up late which, according to the students, disrupted the classroom wellbeing, pointing out that punctuality was as important for lecturers as it was for students. Further, three students shared their concern about some lecturers not adhering to the original work plan. They said that by the mid-semester, some lecturers did not adhere to what was reflected in the introductory work plan. Through these actions, participants indicated that lecturers' punctuality and integrity played a significant role in promoting classroom wellbeing.

### ***Interpersonal Relationships***

Students described the interpersonal relationships between lecturers and students are an important factor in determining classroom wellbeing, believing that positive relationships in the classroom exerted a direct influence on students' wellbeing. In this study, all the participants reported their fondness for a class that promoted good relationship, defined as one that was based on team spirit, cooperation and collaboration between peers and tutors. Consistent with this concept, one of the students said, "[a] good relationship is important and absence of it would discourage them from attending the class and learning would be difficult." Similarly, another student said that positive relationships motivated him to attend classes as it made him feel accepted and included.

Further, students reported that they preferred classes in which lecturers were open to suggestions and to interaction and debates, as well those who were positive, organized, confident and compassionate towards the students. On the other hand, students pointed out a range of lecturers' actions that hampered student wellbeing, which included actions such as scolding, being stern and strict, unequal treatment of student, inconsistent approach to the enforcement of classroom rules, favoring students (teacher partiality) and a lack of interactive and creative teaching. The result suggested that positive interpersonal relationships between lecturers and students were of paramount importance in building trusting relationships that garner greater classroom wellbeing and student learning.

### ***Instructional Resources***

Students cited instructional resources as crucial components of their wellbeing and ensuring effective teaching and learning. They also opined that classroom wellbeing factors such as good learning environment, and teaching learning resources in and outside of the classroom directly influenced student outcomes. Additionally, they felt that library facilities needed improvement as it was difficult to find books appropriate to their needs. Likewise, the books that were available barely provided required information. Consequently, they felt handicapped, as indicated in a quote by S2, “In the library, there are resource constraints because when we go there to look for a particular book, there is no book. Such facilities need improvement”. Students also reported that a few lecturers recommended additional online reading websites and online E-books. Besides, the instructors shared lecture notes, PowerPoint slides, videos, and personal books that are useful for enhancing academic achievement which in turn leads to positive classroom wellbeing.

### ***Classroom Wellbeing***

Classroom wellbeing had a critical role on student learning. When asked about supportive relationships from the teachers, students reflected that classroom wellbeing elements such as inclusion, love, care, etc. contributed to learning. Students also added that for effective learning to take place, the learners should be provided with a conducive environment in the class that equipped learners with physical, psychological, emotional and academic need and render equal opportunities. One student said classroom wellbeing defined our learning, through conducive classroom environments based on positive student-teacher relationships project the outcome of their learning. Students pointed out that factors that make student-to-teacher and student-to-student relationships strong were students being well-known, personally acknowledged, recognized and cared for. S5 explained:

With the time and context, I think the need for classroom wellbeing has become more crucial. Children need more love and care than just bookish knowledge. They need to be made to feel included, encouraged, motivated and supported. For a teacher, it has now become more important to know every child in the class intimately. The mental wellbeing of child needs more attention in today’s classroom. The wellbeing of the classroom will not only help in developing the child holistically, but it can also prevent a child from being engaged in unaccepted social issues like drug addicts, robbery, and gang fights.

Students also expressed that negativity in the class inhibits their learning. Lecturers’ unapproachability and unfriendly nature added to it. Students also identified peers as a source of support for their wellbeing in the class and outside of class constantly providing encouragement, guidance, cooperation, acknowledgement and appreciation. However, certain acts also hindered wellbeing such as being mocked, lack of support and appreciation, disregard and not respecting opinions or views during the class. Conclusively, students in this study valued supportive

relationships from the lecturers and their peers in the form of love, care, guidance, and encouragement as significant aspects of their wellbeing.

## Discussion

The present study focused on an investigation of key areas important to the make-up classroom wellbeing within higher education settings with a view to promote effective student learning. The term wellbeing still defies easy definition in a growing body of research, but often reflects multi-dimensional views of the researchers (Dodge, Daly, Huyton, & Sanders, 2012; Putwain, 2019). We contextualized the term as being directly associated to student learning related to teaching, learning and assessment, which are three dimensions of the academic world. These dimensions depend on lecturers' competence and are critical for ensuring positive classroom wellbeing for the student learning experience.

The present study found that the students uniformly identified six themes including lecturer competence, physical environment, classroom behaviour management, interpersonal relationships, instructional resources and classroom wellbeing as factors that exerts influence on student wellbeing and on their learning, respectively. These findings were relatively predictable, given earlier research. Long et al. (2014) and Matzler and Woessmann (2010) reported lecturers' competencies as being positively correlated to student's satisfaction in terms of learning outcomes. Current finding reinforced these views and indicated that competence of a lecturer and their enthusiasm for subject as a major source of classroom wellbeing. Specifically, concerns were expressed regarding lesson preparation such as upgrading PowerPoint slides to fit current needs and use of relevant instructional methods and assessments to promote creative and effective teaching learning.

Hinton, Miyamoto and Della-Chiesa (2008) indicated that fear and stress could disrupt learning while positive emotions drive learning and students' wellbeing. In addition, an atmosphere of mutual respect made students feel relaxed in asking questions and expressing their thoughts and feelings as crucial for student learning (Stronge, 2018). These statements were corroborated in our finding on physical environment, as our participants indicated that lecturers' emotions related to classroom conduct affected their learning. For example, students confessed that sessions that were open, free, encouraging and rewarding make them want to participate as opposed to classes conducted by lecturers who were often stern, rude, biased and/or unprepared. This finding emphasized the importance of having supportive lecturers that they could relate with.

Marzano and Marzano (2003) asserted that behaviour and classroom wellbeing are two variables that could have the greatest impact on student learning. They further found that teachers' actions in their classrooms had significant impact on student achievement and their wellbeing. Supporting Marzano and Marzano, the findings here showed that, when lecturers failed to adhere to and/or manage classroom rules, such actions (or inactions) impacted student wellbeing negatively and adversely affected learning achievement, suggesting that lecturers' integrity and

punctuality played a significant role in promoting classroom wellbeing. This finding indicates that lecturers' behaviours can have a strong influence in supporting the purposes of Happiness and Wellbeing centre as they use this powerful tool to promote classroom wellbeing.

Interpersonal relationships played a key role in enhancing student wellbeing. These relationships underlined the extent to which students' understanding of wellbeing are conceptualised in social-emotional and relational aspects. Other studies pointed out the key role that interpersonal relationships play (Hattie, 2009; Roffery, 2012). These studies provided more subtle insights into how interpersonal relationships function both implicitly and explicitly within a higher education context. It is now understood that the quality of relationships in an institute can impact students' overall wellbeing and lecturers' and students' ability to handle classroom learning situations (Roffery, 2012), supporting, for example, their deep learning and positive social and emotional development (Schonert-Reichl, 2017). Schonert-Reichl further elaborated that when lecturers failed to manage social and emotional demands of teaching, students' academic achievement and behaviour, both suffered. Our results further built on this evidence suggesting that it was the quality of the interpersonal relationships that lecturers embodied in the daily activities of classroom including quality of care, love and readiness to support that students perceived to be the most critical. This result of our study aligned with the core principles and values of GHN, which is to promote love, compassion, patience, tolerance, contentment, harmony and social responsibility. Furthermore, this finding provided a useful indicator for practitioners working with students to develop qualities that are essential for their wellbeing and learning.

The study concluded that lecturers' competence in terms of lesson delivery, using appropriate instructional methods, unbiased assessment practices, maintaining positive interpersonal relationship, positive approach and good classroom behavioural management can effectively promote classroom wellbeing and heighten students' satisfaction with higher education life and can support a better learning environment at higher education institutions. This finding connected with Muzenda (2013) and Long et al. (2014) who found positive correlations between lecturers' competence and level of students' satisfaction in academic achievements. It also supported the idea of our classroom wellbeing definition that "a classroom that encourages emotional security, creates conducive and safe learning environment as well as ensures transparent teaching, learning and assessment practices is crucial," which can lead to students wanting to open up and appreciate learning.

## **Conclusion**

The results from the current study suggested that an extended version of our proposed study definition could represent the way students perceive classroom wellbeing in higher education. However, we proposed the need for students and lecturers to undergo fundamental

changes to materialize the goals and aspirations of the Happiness and Wellbeing centre as well as principles and values of GNH to achieve greater classroom wellbeing.

The study also concluded that classroom wellbeing can have a significant role on student learning. Classroom wellbeing factors such as lecturer competence, interpersonal relationship, lecturer's behaviour management, and physical environment were pertinent to determining student learning. The students also claimed to have experienced benefits when classroom wellbeing was ensured through factors like having access to positive learning environment, appropriate teaching and learning materials, and a technological-based classroom.

Finally, this study contributed to the theory development in the field with the notion that it was useful to pay attention to varied features of classroom wellbeing and their impact on student learning with a hope that education at all levels can be improved for the benefits of students, educators and society at large. Concurrently, it may also inform and guide policy makers at national and institution levels in framing policies related to the classroom wellbeing considering the understanding of educators and students at all levels of education.

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## Appendix A: Interview Questions

- 1) Tell me something about classroom wellbeing.
- 2) What makes you feel welcome/unwelcome in the classroom?
- 4) What is your ideal class setting?
- 5) How would you describe your experience of being a student in terms of your wellbeing?

- 6) What makes you feel included /excluded in the class?
- 8) Is there anything stressful about being a student in that particular class?
- 9) What encourages you to do best or keeps you from doing best in the class?
- 11) How do your feelings about the teacher/peer/classmates affect your learning in the class?
- 12) Do you think classroom wellbeing has impact on learning? IF Yes and No.... How and why?

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## DIFFERENCES IN FORMAL EDUCATION AMONG NORWEGIAN HOME ECONOMICS TEACHERS

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### Abstract

Many Norwegian teachers in Food and Health (Home Economics) do not have any formal subject-specific education. This study aims to explore potential differences between teachers with formal versus no formal Food and Health education. In 2018, Food and Health teachers in all primary and lower secondary schools in Norway were invited to answer a web-based questionnaire. In total, 1170 Food and Health teachers completed the questionnaire. We found several differences between the groups. Most importantly, 49% of the teachers at the secondary school level had formal Food and Health education despite national requirements. Also, a higher proportion of the formally educated group showed more contentment with teaching and reported to a greater extent mastering teaching ( $p \leq 0.001$ ) compared to the non-educated group. With higher coverage of formally educated teachers in Food and Health, the subject can be strengthened towards fulfilling its potential of being influential for motivation, knowledge and life skills related to food and health.

**Keywords:** home economics, food and health, experiences, education level, teachers, questionnaire, Norway

### Introduction

In Norway, compulsory school consists of 10 years for all students and Home Economics has been a part of the Norwegian school curriculum since 1890 (Askeland et al., 2017). The subject has undergone some changes during previous years, e.g. up until 1959 it was mandatory only for girls, but after that it became mandatory for both genders. In 2006, Home Economics was replaced with the school subject Food and Health (FH). The subject remained mandatory in primary and lower secondary school. FH aims to provide students with the ability to critically reflect on food choices and meals, and develop cooking skills to obtain a health-promoting lifestyle (The Norwegian Directorate for Education and Training, 2006). In 2015, the Ludvigsen

committee was appointed by the Norwegian government to address what students need to learn in school in a perspective of 20 to 30 years, i.e. which competences will be important in further education and working life, and how to be responsible members of society (Ludvigsen, 2015). Based on input from the Ludvigsen committee, one of three overarching interdisciplinary topics in the core curriculum (to be applied from 2020) will be *health and life skills* (The Norwegian Directorate for Education and Training, 2019a). Life skills refers to the ability to understand and influence factors that are important for mastering one's own life. The topic *health and life skills* aims to give the students competence which promotes sound physical and mental health and enables them to make good health choices that have great impact on health e.g. lifestyle habits (The Norwegian Directorate for Education and Training, 2019a).

A healthy diet is fundamental for good health. An unhealthy diet is an important preventable risk factor for non-communicable diseases (NCDs), such as cardiovascular diseases, diabetes type II and obesity. This is well documented by the Global Burden of Disease Study 2017 where Norway is included (Afshin & Collaborators, 2019). Norwegian children have a diet with low intakes of wholegrain, fish, fruits and vegetable (Hansen et al., 2015). According to the new curriculum of 2019 (The Norwegian Directorate for Education and Training, 2019b), the school subject FH in Norway is important in teaching the students how to plan, cook and experience a meal together with their peers according to the dietary guidelines. Further, the subject is important for students to establish an understanding of how food is related to their own health. In a public health perspective, large societal gains may be acquired in prevention of NCDs, if the population adhered to dietary guidelines (Sælensminde et al., 2016). Dietary habits develop early and track into adulthood (Craigie et al., 2011; Scaglioni et al., 2018). Since all children in Norway attend school, FH may contribute fundamentally to the attainment of dietary life skills.

In 2018 there were 2821 primary schools and lower secondary public schools in Norway (according to Statistics Norway), and FH were taught in almost all schools (except a few international schools). Statistics Norway published a report documenting teachers' formal qualification in the subjects they teach, including FH, in primary and lower secondary school. The report showed that FH has the lowest proportion of teachers with 60 ECTS (European Credit Transfer and Accumulation System) in FH from their teacher training and that 6 out of 10 teachers in FH across primary and lower secondary school do not have any formal education in FH at all (Perlic, 2018/19).

In a report from 2008, Falch and Naper studied how teachers' formal education affects students' achievements in final exams. They found that an increased formal teacher competence (i.e. university degree vs. a lower educational degree) was related to increased academic achievements among students, but found no association between the subject specific formal education and academic achievements (Falch & Naper, 2008). Mathematics and basic reading skills were used as examples of students' academic performance on national tests and final exams in the report (Falch & Naper, 2008) and FH was not a part of this study. International studies have also found that having completed a formal teacher training, is an important factor affecting student

achievement (Andersson et al., 2011; Darling-Hammond, 1999). Contrary to the findings of Falch and Naper (2008), other international studies have shown that certified teachers with subject-specific education are important for student achievement (Blank & de las Alas, 2009; Darling-Hammond, 1999; Darling-Hammond & Youngs, 2002; Kunter et al., 2013; Metzler & Woessmann, 2012), and that "student learning should be enhanced by the efforts of teachers who are more knowledgeable in their field and are skilful at teaching it to others" (Darling-Hammond, 1999)(page 33). The term "pedagogical content knowledge" (PCK), the combination of content knowledge and pedagogical knowledge (Shulman, 1987) is often mentioned in the literature (Fauth et al., 2019; Förtsch et al., 2016; Kunter et al., 2013). A large study on teacher's self-efficacy in 14 OECD (Organisation for Economic Co-operation and Development) countries found, amongst other, that teacher's self-efficacy was strongly linked to student achievement and that experienced teachers had higher self-efficacy (Fackler & Malmberg, 2016). Finally, in addition to self-efficacy, competencies, like showing enthusiasm and being a visible leader may have a positive impact on student achievement (Fauth et al., 2019; Kunter et al., 2013; Nordenbo et al., 2008).

Educating high-quality teachers with subject-specific competences has been an important political initiative in Norway in recent years (Ministry of Education and Research, 2014, 2015). As a result, in some subjects, 30 ECTS are now required to teach a subject at the primary school level and 60 ECTS are required at the lower secondary school level (The Norwegian Directorate for Education and Training, 2015). The requirements for teaching FH in lower secondary schools consist of at least 30 ECTS (i.e. formal FH education) as part of the teacher training (The Norwegian Directorate for Education and Training, 2015). These requirements only apply to teachers with a permanent position, hired after January 1st, 2014. In primary schools, there are no requirements for a subject-specific education in FH. Consequently, a newly published report assessing policy and efforts regarding healthy food environments in Norway suggests specifically to require teachers to have subject-specific education to teach FH as a means to strengthen nutrition work in the public sectors (Torheim et al., 2020). This acknowledges the importance of qualified teachers in order to serve as a health-promoting subject. Food and Health is a complex subject to teach and some teachers are not aware of their lack of subject specific competence themselves (Ask et al., 2020).

The ethical aspects in food and health are important to consider as it addresses the students' own health. Careful considerations are needed to avoid students feeling blame for an unhealthy diet or lack of food knowledge. The topic may give positive attention to the importance of food and health but may also lead to negative attention, e.g. eating disorders which are important to be aware of.

In order to understand how the subject FH can be strengthened to fulfil its potential of influence motivation, knowledge and skills related to food and health, more knowledge is needed concerning the educational level among teachers in FH; to which degree FH teachers feel that they master their work, whether and to which degree they are content with teaching FH, and how

satisfied they are with how the subject is taught in schools today.

The aim of this study was to explore potential differences between teachers with formal versus no formal subject-specific Food and Health education regarding school level, gender, age, length of experience in teaching, contentment and feeling of mastering teaching Food and Health, and whether they include basic skills, and seeing potential needs for a renewal of Food and Health in Norway.

## Method

This present study is a part of a wider project called LifeLab Food and Health. The design was cross-sectional, and the data was collected between April and May in 2018. Prior to this, a short email containing an introduction to the project and a link to the project's home page ([www.uia.no/lifelab](http://www.uia.no/lifelab)) was distributed to the head teachers at all primary schools and lower secondary schools in Norway (n=2821). The web page contained an anonymous online questionnaire and the details about the study. The head teacher at each school was asked to redistribute the email to their FH teachers, being the target group for the study. An invitation to participate in the survey was also published on two Facebook pages relevant for teachers in FH, in addition to an advertisement in the journal published by The Norwegian Association for teachers in Food and Health. The anonymous, web-based questionnaire was made using SurveyXact 8.2 and contained some items from a previously used questionnaire (Bottolfs, 2020). The FH teachers gave their consent by answering the questionnaire. Two reminders were sent within five weeks after the initial email distribution. The questionnaire was closed for participants approximately two weeks after the last reminder. The LifeLab Food and Health project was approved by the Norwegian Centre for Research Data (ref.59097), and the Ethical committee of Faculty of Health and Sport Sciences at the University of Agder.

## Measures

The questionnaire contained 25 items covering demographics, structure of the FH subject, contentment of teaching in FH and seeing potential needs for a renewal of FH. The items were developed in collaboration with colleagues at University of Agder. The survey was pilot tested among colleagues with experience working as FH teachers. Age were measured by “What is your age” and the response categories were: 18-21, 22-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60 and >60. These were merged and recoded into the categories 18-30, 31-40, 41-50, 51-60 and >60 which represented the distribution of the data (table 1). Length of experience as a FH teacher was measured as “How many years have you worked as a FH teacher (including home-economics)?”. The response categories were: <1 year, 1-5 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years and 26 years or longer. These categories were merged into 0-5 years, 6-15 years and ≥15 years which represented the distribution of the data (table 1).

Formal subject specific education in FH were measured by “what is your educational level

in FH? The 11 response categories were "1=general teacher without formal training in FH", "2=general teacher with 15 ECTS in FH", "3=general teacher with 30 ECTS in FH", "4=general teacher with 60 ECTS in FH", "5=30 ECTS in FH without general teacher education", "6=60 ECTS in FH without general teacher education", "7=Home Economics teacher (old title)", "8=chef", "9=restaurant and food processing (from upper secondary school)", "10=unskilled/assistant" and "11=other". Some of the answers in the open-ended "other" alternative were manually moved into one of the other categories based on what was considered appropriate. For example, answers like chefs or bachelor's degree in nutrition who also holds a pedagogical degree were placed at general teacher without formal training in FH as both chef and bachelor's degree in nutrition do not qualify for teaching FH. The FH education variable was recoded into a dichotomized variable denoting teachers with formal FH education (response category 2,3,4,7; n=512) and teachers without formal FH education (response category 1,5,6,8,9,10,11; n=658). School levels of teaching were measured by "which level do you teach FH"? Response categories were from grade 1 to grade 10, and they were merged into two categories: teaching at primary school level (grades 1-7, n=615) and secondary school level (grades 8-10, n=555).

### **Contentment as a FH teacher and Extent of Mastering the Subject**

Contentment as a FH teacher was measured by "How content do you feel with teaching FH?", and the response categories were: *Very content, content, neither content nor not content, little content and very little content*. They were merged into three categories: Very content/content, neither content nor not content, little content/very little content. Mastering the task of teaching FH were measured by "To what extent do you feel that you master teaching in FH?". The response categories were: *very large extent, large extent, to some extent, to little extent, very little extent*. Responses were merged into two categories: Very large/large extent and to some/little/very little extent. This was due limited number of responses in some categories, and therefore represented the distribution of the data.

### **Teachers Views on Content of Food and Health**

Teachers were asked about how they include basic skills in their teaching by: "To what extent do you include the five basic skills (oral, writing, reading, mathematics, use of digital skills) in your FH teaching?" Use of dietary guidelines in FH class were measured by "To what extent do you follow the dietary guidelines when deciding what food to make in FH class?" The response categories for both items were: *very large extent, large extent, to some extent, to little extent, very little extent*. Response categories were merged into 2 categories: Very large/large extent and to some extent/little/very little. This was due limited number of responses in some categories, and therefore represented the distribution of the data. Relevance to the society was measured by: "To what extent do you feel that food and health is viewed as relevant for the society?" Attitudes

regarding diet and health were measured by: “To what extent do you feel that teaching FH fosters positive attitudes towards diet and health?” Being a resource person for the students were measured by: “To what extent do you regard FH teachers as a resource in prevention and health promotion among students?” The response categories for these three items were: *very large extent, large extent, don’t know, to little extent, not at all*. Response categories were merged into three categories: Very large/large extent, don’t know, to little extent/not at all which represented the distribution of the data. Regarding a potential need for renewal of FH in Norwegian schools, the teachers were asked: “Do you feel a need for a renewal of FH?” The response alternatives were: *No, it works fine as it is* or *yes, it’s time for a renewal*.

### Statistics.

All data were analysed using the IBM SPSS statistical software package version 25.0. For all tests,  $P \leq 0.05$  was considered significant. Descriptive statistics with frequencies in percentages were used. Cross tabulation (Chi-square tests) were used to test differences between groups.

### Results

An overview of the proportions of different educational levels among FH teachers in Norway is presented in table 1 (Appendix). In total, 1170 FH teachers completed the questionnaire of whom 43.8% had formal FH education (EDU group) ( $n=512$ ) and 56.2% had no formal FH education (no EDU group) ( $n=658$ ) (table 2, Appendix). Among the teachers teaching at secondary school level ( $n=555$ ), grade 8-10, 48.6% had a formal FH education (data not shown). A higher proportion of the EDU group taught at lower secondary school level compared to the no EDU group ( $p \leq 0.001$ ). There were more women than men ( $>85\%$ ) in the total sample, but there were no gender differences between the EDU group and the no EDU group (table 2).

In this data, a higher proportion of the EDU group was younger ( $p \leq 0.001$ ) and had more years of experience teaching FH compared to the no EDU group ( $p \leq 0.001$ ) (table 2). Likewise, a higher proportion of the EDU group showed contentment with teaching FH ( $p \leq 0.001$ ) and reported to a larger extent to master the teaching of FH compared to the no EDU group ( $p \leq 0.001$ ) (table 2). A higher proportion of the EDU group reported including the basic skill of writing in FH classes compared to the no EDU group ( $p=0.02$ ) (table 3, Appendix). A higher proportion of the EDU group was in favour of a renewal of the subject while a higher proportion of the no EDU group reported that the subject works fine as it is ( $p=0.01$ ) (table 3).

### Discussion

According to our findings, 44% of the teachers in the total sample engaged in teaching FH had formal FH education. Further, when only looking at teachers teaching FH in lower secondary school, 49% of the teachers were formally qualified. Teachers with formal FH education were

younger and had longer experience teaching the subject than the no EDU group (teachers without formal FH education). In the EDU group, more teachers felt they mastered their job and felt more content with teaching FH than in the no EDU group. More teachers in the EDU group reported including writing as a basic skill compared to the no EDU group and more teachers in the EDU group were in favour of a renewal of the subject compared to the no EDU group. These results were for the total sample, regardless national requirements of formal education in Food and Health.

Given that the requirements for formal education (ECTS in FH) only apply to lower secondary school and for teachers hired after January 1st, 2014, it is not surprising that a higher proportion of teachers in the EDU group teaches at the lower secondary school level. The new requirements for formal education in FH from 2014 may explain why there were only half of the teachers that complied with 30 ECTS and why there were a higher proportion of younger teachers in the EDU group. This contrasts with the most recent report from Statistics Norway which found that a higher proportion of older teachers had formal education in FH compared to their younger colleagues (StatisticsNorway, 2019). FH has the largest proportion of teachers without subject-specific education across all subjects (StatisticsNorway, 2019). Because the practical aesthetical subjects like FH have no requirements to formal education in primary school and a lower requirement (30 ESCT) in lower secondary school compared to some other subjects, this may create a gap in the quality of teaching between these subjects, and maybe more importantly, the learning outcome among the students. FH aims to provide students with the ability to critically reflect on food choices and meals in order to adhere to a health-promoting lifestyle (The Norwegian Directorate for Education and Training, 2006). Given the importance of teachers' subject specific education on student achievement discussed initially e.g. (Blank & de las Alas, 2009; Kunter et al., 2013; Metzler & Woessmann, 2012) such in-depth and complex issues should be taught by well qualified teachers, as highlighted by (Darling-Hammond, 1999). From 2020, a master's specialization in FH as part of teacher training will be offered in Norway. This may contribute to a higher number of educated teachers in FH and further increase the status of the subject.

A higher proportion of teachers with formal FH education had longer experience teaching the subject than the no EDU group, indicating that the EDU group, to a greater extent, continue teaching FH when they first get assigned to teaching it. A higher proportion of teachers in the EDU group felt they mastered their job compared to the no EDU group in addition to feeling more content with teaching. The difference between the groups might be explained by the importance of having subject-specific competence in order to increase teacher self-efficacy (Nordenbo et al., 2008). As discussed initially, a higher level of self-efficacy might also support student achievement (Fackler & Malmberg, 2016).

Although there was a significant difference between the two groups, both groups reported high levels of contentment in teaching FH and to master their teaching in FH (around 90%). It is likely to assume that teaching a subject one has no specialization in, may make you feel more

insecure and less content. Similar findings are reported in the school subject survey conducted in 2013 (Espeland et al., 2013, p. 109). They also found both educated and non-educated FH teachers rating their competence as high, the majority lacking FH education. The authors therefore wonder if the teachers draw on their own experiences when evaluating their competence, as being an experienced cook at home equals being a qualified FH teacher.

A higher proportion of teachers in the EDU group included to a greater extent the basic skill of writing in their FH teaching compared to the no EDU group. Basic skills like reading and writing, being able to express yourself orally, mathematics and the use of digital skills are meant to be incorporated into the competence aims in all subjects in school. According to the curricula, examples of writing skills in FH can be to describe taste, smell and aesthetics, written work, or to write down own recipes and methods related to the practical work (The Norwegian Directorate for Education and Training, 2006). The other four basic skills (oral, reading, mathematics, digital skills) were all included to a large extent in FH teaching, but we did not find any differences between the two groups.

Although a fairly high number of teachers in both groups felt it is time that the FH subject need to be renewed, a higher proportion of FH teachers in the EDU group expressed this to a larger extent. Teachers who have studied FH in their teacher training might see challenges and opportunities to a greater extent, than the no EDU group.

### **Strengths and limitations**

There are some limitations to be considered. This study was based on self-reported data relying on memory which can introduce response bias. Further, the results may be affected by social desirability bias and misinterpretations (Moy & Murphy, 2016). Also, a survey will not explore any phenomenon in depth, which may leave out interesting and valuable aspects. The questions and answers were to a large degree fixed, which may omit important information since the respondent cannot answer freely. Since the survey was anonymous, we do not know if the response rate reflects the number of schools approached in the recruitment process (n=2821) nor if it reflects the entire population of FH teachers in Norway. We also do not know if the spread of the data is associated with geography, and these represent limitations. As the email was sent to all schools in Norway, we think there are reasons to assume a fairly equal geographical spread of the data, but the results should be interpreted with caution. Concerning bias in the response rate and which teachers actually responded, it is likely that the teachers interested in the topics raised in the questionnaire responded, while the teachers that did not have any interest in these matters did not respond, introducing a bias that may influence the validity of our results. If this assumption holds, teachers with formal education in Food and Health may be overrepresented in the study,

and the “true” proportion of formally qualified FH teachers may be even lower than what we report. Finally, the research design is cross-sectional, and causal relations cannot be drawn.

There are also strengths to the present study. Given the large sample of participating teachers (n=1170), this is to our knowledge the largest nationwide survey among teachers in FH in Norway. This may be a sign that teachers find it important to contribute to research in this subject in general, as research on the subject is still limited. This survey is to date the only one which has explored the various aspects examined here, except qualification which Statistics Norway regularly assesses. The survey was also pilot tested among colleagues with work experience as FH teachers. The anonymous and self-administered nature of the survey may reduce the presence of social desirability bias (Bryman, 2016). Other advantages of web-based questionnaires compared to paper-based questionnaires include low cost of administering and, less time-consuming analysis process, as responses can be directly transferred into analysis software (Bryman, 2016). Finally, participants were able to answer at any electronic device (smart phone, tablet, or computer), at any time which may suit them.

## Conclusions

Our findings revealed that about half of the teachers in lower secondary school had formal FH education, despite national requirements of having at least 30 ECTS in FH.

We also found that teachers with formal education in FH were more content and reported to master their teaching to a larger extent than those with no formal FH education. FH is an important subject in school as it relates to both current health and future health of children and adolescents. A stronger emphasis on quality teaching from well-trained teachers should therefore be of interest, as the subject is important in a public health perspective.

With an ongoing focus on increasing teacher competence and a new master’s degree in FH being offered at universities in Norway from 2020, the number of educated teachers in FH may increase in the future. With higher coverage of formally qualified teachers, the subject food and health can be strengthened and thus more likely be able to fulfil its potential of being an influential channel for motivation, knowledge and skills related to food and health among children and adolescents in Norway.

Based on the findings from this survey, we propose further research to explore teacher competence regarding FH in Norway. Special emphasis should be placed on their subject specific competence in FH and how this might affect student achievements and competency aims outlined in the curriculum.

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## Appendices

**Table 1**

*Food and Health teachers' education level and level of teaching. In total: 1170 participants*

|                                                                        | n   | %    |
|------------------------------------------------------------------------|-----|------|
| Teacher education without FH competence                                | 409 | 35.0 |
| Teacher education with FH competence, 30 ECTS in FH (1/2 year)         | 208 | 17.8 |
| Teacher education with FH competence, 60 ECTS in FH (one year)         | 198 | 16.9 |
| Teacher education with FH competence, 15 ECTS in FH (1/4 year)         | 90  | 7.7  |
| Other                                                                  | 65  | 5.6  |
| FH competence (60 ECTS) without general teacher education              | 56  | 4.8  |
| Unskilled/Assistant                                                    | 55  | 4.7  |
| Chef                                                                   | 41  | 3.5  |
| Restaurant and food processing (upper secondary school level)          | 23  | 2.0  |
| Home economics teacher (old title)                                     | 16  | 1.4  |
| Food and Health competence (30 ECTS) without general teacher education | 9   | 0.8  |
| Teaching primary school level (grade 1-7)                              | 615 | 52.6 |
| Teaching lower secondary school level (grade 8-10)                     | 555 | 47.4 |

*Notes.* Descriptive statistics, frequencies. FH: Food and Health

**Table 2**

*Food and Health teacher's school level, gender, age, experience in teaching, contentment and mastering the job according to formal education level. In total: 1170 participants*

|                                     | Teachers with<br>formal FH education<br>(EDU group)<br>n (%)<br>n=512, 43.8% | Teachers without<br>formal FH education (no<br>EDU group)<br>n (%)<br>n=658, 56.2% | p-value       |
|-------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------|
| Teaching grade                      |                                                                              |                                                                                    |               |
| Primary school (grade 1-7)          | 242 (47.3)                                                                   | 373 (56.7)                                                                         |               |
| Lower secondary school (grade 8-10) | 270 (52.7)                                                                   | 285 (43.3)                                                                         | <b>≤0.001</b> |
| Age                                 |                                                                              |                                                                                    |               |
| 18-30                               | 84 (16.4)                                                                    | 64 (9.7)                                                                           |               |
| 31-40                               | 119 (23.2)                                                                   | 142 (21.6)                                                                         |               |
| 41-50                               | 138 (27.0)                                                                   | 208 (31.6)                                                                         |               |
| 51-60                               | 131 (25.6)                                                                   | 162 (24.6)                                                                         |               |
| >60                                 | 40 (7.8)                                                                     | 82 (12.5)                                                                          | <b>≤0.001</b> |
| Gender                              |                                                                              |                                                                                    |               |
| Women                               | 452 (88.3)                                                                   | 571 (86.8)                                                                         |               |
| Men                                 | 60 (11.7)                                                                    | 87 (13.2)                                                                          | 0.44          |
| Experience in teaching FH           |                                                                              |                                                                                    |               |
| 0-5 years                           | 213 (41.6)                                                                   | 401 (60.9)                                                                         |               |
| 6-15 years                          | 181 (35.4)                                                                   | 171 (26.0)                                                                         |               |
| >15 years                           | 118 (23.0)                                                                   | 86 (13.1)                                                                          | <b>≤0.001</b> |
| Contentment with teaching FH        |                                                                              |                                                                                    |               |
| Very content/content                | 498 (97.3)                                                                   | 602 (91.5)                                                                         |               |
| Neither content/ nor not content    | 12 (2.3)                                                                     | 42 (6.4)                                                                           |               |
| Little content/ very little content | 2 (0.4)                                                                      | 14 (2.1)                                                                           | <b>≤0.001</b> |
| Feeling of mastering teaching FH    |                                                                              |                                                                                    |               |
| Very large/large extent             | 495 (96.9)                                                                   | 583 (89.3)                                                                         |               |
| To some extent/little/very little   | 16 (3.1)                                                                     | 70 (10.7)                                                                          | <b>≤0.001</b> |

Notes. \*Chi-square test was used to test differences between the two educational groups. FH: Food and Health. Significant p-values in bold.

**Table 3**

*Food and Health teacher's questionnaire responses according to having formal FH education or not. In total: 1170 participants*

|                                                                        | Teachers with<br>formal FH education<br>n=512, 43.8%<br>n (%) | Teachers without<br>formal FH education<br>n=658, 56.2%<br>n (%) | p-value*    |
|------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------|-------------|
| Use of dietary guidelines in teaching                                  |                                                               |                                                                  |             |
| Very large/large extent                                                | 339 (66.2)                                                    | 401 (60.9)                                                       |             |
| To some extent/little/very little                                      | 173 (33.8)                                                    | 257 (39.1)                                                       | 0.06        |
| Ability to positively influence students' attitude towards FH          |                                                               |                                                                  |             |
| Very large/large extent                                                | 430 (84.0)                                                    | 540 (82.1)                                                       |             |
| Don't know                                                             | 64 (12.5)                                                     | 90 (13.7)                                                        |             |
| To little extent/not at all                                            | 18 (3.5)                                                      | 28 (4.3)                                                         | 0.66        |
| FH teachers being a resource person in health promotion among students |                                                               |                                                                  |             |
| Very large/large extent                                                | 451 (88.1)                                                    | 551 (83.7)                                                       |             |
| Don't know                                                             | 46 (9.0)                                                      | 82 (12.5)                                                        |             |
| To little extent/not all al                                            | 15 (2.9)                                                      | 25 (3.8)                                                         | 0.11        |
| Use of Skills, oral                                                    |                                                               |                                                                  |             |
| Very large/large/some extent                                           | 504 (98.4)                                                    | 641 (97.4)                                                       |             |
| little/to very little extent                                           | 8 (1.6)                                                       | 17 (2.6)                                                         | 0.23        |
| Use of Skills, writing                                                 |                                                               |                                                                  |             |
| Very large/large/some extent                                           | 432 (84.4)                                                    | 520 (79.0)                                                       |             |
| little/to very little extent                                           | 80 (15.6)                                                     | 138 (21.0)                                                       | <b>0.02</b> |
| Use of Skills, reading                                                 |                                                               |                                                                  |             |
| Very large/large/some extent                                           | 509 (99.4)                                                    | 651 (98.9)                                                       |             |
| little/to very little extent                                           | 3 (0.6)                                                       | 7 (1.1)                                                          | 0.38        |
| Use of Skills, mathematics                                             |                                                               |                                                                  |             |
| Very large/large/some extent                                           | 505 (98.6)                                                    | 651 (98.9)                                                       |             |
| little/to very little extent                                           | 7 (1.4)                                                       | 7 (1.1)                                                          | 0.64        |
| Use of Skills, digital skills                                          |                                                               |                                                                  |             |
| Very large/large/some extent                                           | 505 (98.6)                                                    | 651 (98.9)                                                       |             |
| little/to very little extent                                           | 7 (1.4)                                                       | 7 (1.1)                                                          | 0.64        |
| Experience of the FH subject having relevance to the society           |                                                               |                                                                  |             |
| Very large/large extent                                                | 338 (66.0)                                                    | 466 (70.8)                                                       |             |
| Don't know                                                             | 47 (9.2)                                                      | 60 (9.1)                                                         |             |
| To little extent/not at all                                            | 127 (24.8)                                                    | 132 (20.1)                                                       | 0.14        |
| Need for renewal of FH in schools                                      |                                                               |                                                                  |             |
| No, it works fine as it is                                             | 265 (51.8)                                                    | 390 (59.3)                                                       |             |
| Yes, it's time for a renewal                                           | 247 (48.2)                                                    | 268 (40.7)                                                       | <b>0.01</b> |

Notes: \*Chi-square test was used to test differences between the two educational groups. FH: Food and Health. Significant p-values in bold.

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# **EFFECT OF STATION ROTATION MODE OF INSTRUCTIONAL DELIVERY FOR MATHEMATICS IN THE ERA OF ADVANCING TECHNOLOGY**

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## **Abstract**

Mathematics as a core subject in sciences and other aspects of human lives requires quality teaching to enhance learning and proper understanding. This idea prompted the Station Rotation Model of instruction used in this study for teaching secondary school students mathematics. From six educational districts in Lagos State, Educational District IV was selected randomly. Two senior secondary schools were purposively selected from the district being schools with well-equipped and functioning computer laboratory, and these schools were randomly assigned to experimental and control. The study adopted the pretest, posttest, control group quasi-experimental design to ascertain if there was a difference between the achievement and attitude of students taught mathematics with station rotation and those taught with conventional method. The two instruments used were Mathematics Achievement Test (MAT) and Attitude towards Mathematics Inventory (ATMI) adapted from Tapia and Marsh (2004). The data were analyzed using ANCOVA. The treatment was found to have a significant difference in achievement but not on the attitude of students. These results suggest that the station rotation model of instruction should be adopted in teaching mathematics.

**Keywords:** achievement, advancing technology, attitude, mathematics, station rotation model

## **Introduction**

The proper teaching of mathematics is required to enhance understanding of the subject for proper application of the knowledge in every facet of life. Mathematics is an important subject that has its application in subjects of different kinds, various sectors, the economy, and practically every aspect of human endeavor. The discipline is very vital in the scientific and technological foundation as well as the socio-economic development of any nation. Mathematical skills are useful in entrepreneurship, and in solving problems of any kind either real-life like educational, marital, poverty, health, or generally, economic problems. Mathematics is required for any reputable or desire courses like medicine, architecture, and engineering programs. It is also an essential tool needed for all sciences and technology (Ogunleye, 2009).

However, the performance of students in secondary school mathematics is not encouraging

(Busari & Akinoso, 2020). Due to the importance attached to this subject action needs to be taken immediately with one area to be addressed being teaching strategies aimed to improve performance of students. Currently, different strategies for teaching mathematics include inquiry-based learning, personalized instruction, teamwork/collaborative learning, visualization or concrete-representation-abstract instructional strategy, cooperative learning, differentiated instruction, explicit instruction, and others. A good mathematics teacher should have knowledge of different teaching strategies and they should be able to apply the strategies according to the needs of the students. Included in this set of strategies is incorporating technology to mathematics teaching. It is the purpose of this study to look at the effectiveness of one approach of teaching mathematics with technology.

## **Literature Review**

Akinoso (2015) has suggested that the world is so volatile, uncertain, complex, and ambiguous and that anything can happen at any time, that could interrupt the coming together of students in a classroom setting. No matter what happens, learning must continue but it might not occur that way it had previously. Students will require instructional strategies that can help improve learning with the technology-based skill to prepare for a proper understanding of the subject. An example of such occurrence is the outbreak of the present pandemic which moved the teaching of many students from the classroom settings to other settings, often online or e-learning. But students do not need a world crisis to benefit from learning via technology.

## **Technology and Mathematics Teaching**

Information and Communication Technology (ICT) usage contributes to the building of a fast-growing society. E-learning, as stated by Shashikala (2019), comprises electronically supported learning and teaching. There is no doubt that conventional learning has its advantages but online or e-learning is properly known and practiced for distance, open and flexible education but within a given situation. Further, the combination of online learning with the traditional classroom settings, especially in case of any emergency, can be a great advantage.

Odumosu, Oluwayemi, and Olatunde (2012) have suggested that today's learners need to be exposed to modern technologies for optimal learning. For example, in computer literacy and attitude to computer as the predictors of chemistry teachers' utilization of technology, Ogunleye, (2010) believed that teaching chemistry cannot be limited to the use of traditional texts or conventional teaching which is a teacher-centered strategy but to incorporate the use of technology. The use of this technology is not limited to the teaching and learning of chemistry but to other subjects, including mathematics.

The world of education is changing, moving from traditional teaching to a combination with an online mode where students discover some facts and learn any time anywhere. The world

itself is now a global village in which both the teachers and students can reach out to any part of the world to have the ideal of their education system, access any concepts online, learn through the video lecture from different parts of the globe and ask or submit questions when necessary for clarification. For students to connect with their colleagues globally, be informed, and become responsible global citizens and for them to be closer to all parts of the globe there should be what is been referred to as globalization which promotes awareness and knowledge of global interdependence. Teaching and learning of any program cannot be limited to reading, writing, and arithmetic only. Panneer Selvam (2014) averred that the principle of globalization is to shift the teaching-learning process from reading, writing, and arithmetic to communication, collaboration, critical thinking, and creative problem-solving. Moreover, classroom teaching has been transformed from the traditional way of teaching to the use of technology, where communication, collaboration, critical thinking, and creative problem-solving are also the potential benefits of online teaching. Technology advances daily and, using the internet, students can be connected from every part of the world for virtual learning. Meetings of different kinds can be held as if students were together in a hall using different platforms like Zoom, Google, and others.

In this era of technology, the conventional way of learning might not be enough, but it can provide a foundation, since there is information and communication technology through which students can be connected to others, regardless where they are. For mathematics teachers to provide global education to the students, the teacher must incorporate and allow communication, collaboration, critical thinking and creative problem solving to reflect in the teaching-learning of mathematics.

To meet the needs of this new situation, both teachers and students need to learn how to use the online space. One potential way to accomplish this goal and to make the learning of mathematics at a senior secondary level more meaningful, interesting, and efficient to students, station rotation learning can be introduced as a method of instruction to contribute actively to classroom instruction and improve learning outcomes of mathematics at senior secondary school level.

### **The Station Rotation Model**

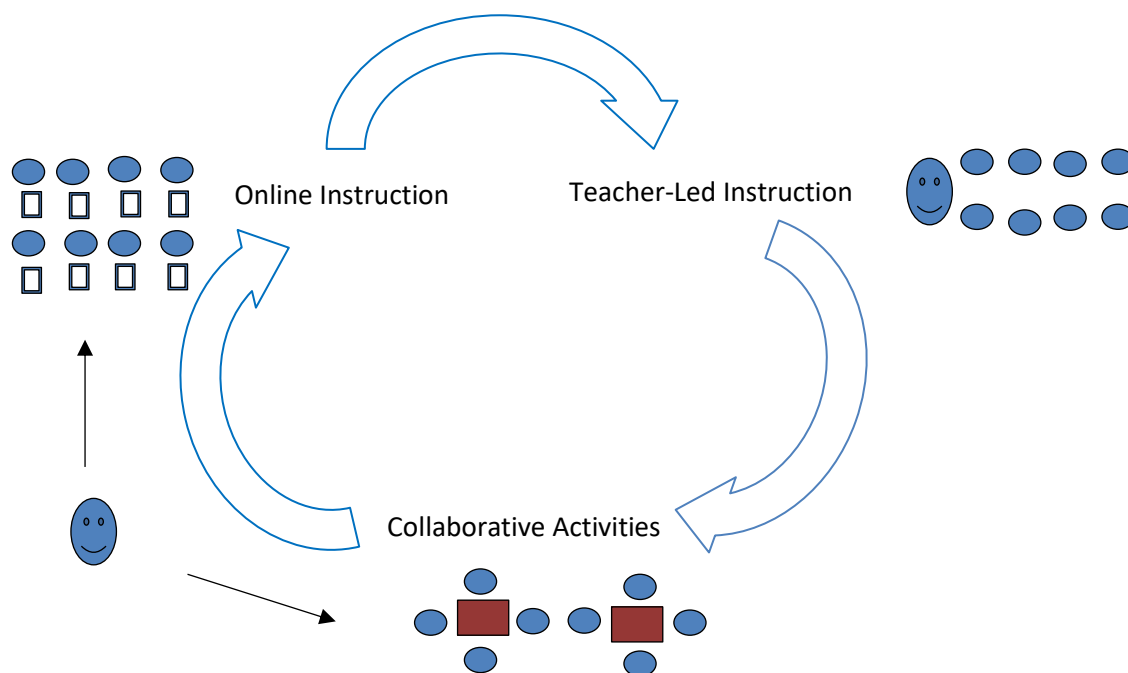
The station rotation model of instruction, a form of blended learning, involves the use of technology combining the internet with a more traditional classroom settings (Kerres & Witt, 2003). In support of the definition given above, Stacey and Gerbic, (2007) defined the station rotation model of instruction as the combination of a customary classroom teaching approach with a variety of online resources. The station rotation model of instruction requires that students are placed into different groups and, together, move from one learning division to another. The rotation stations include teacher-led instruction, collaborative activities, and online instruction. One possible configuration of the model is seen in Figure 1.

Tavangarian, Leybold, Nölting, Röser and Voigt (2004) emphasized that, whether

networked or not, the information and communication system is a specific medium to implement the learning process. This idea suggests how important the station rotation model of instruction is in the field of teaching. In support of the combination, Yusuf, (2020) believed that with the advancement in technology, teaching is gradually moving from onsite to the online mode where the students read, watch, or listen, complete problems or answer questions, explore simulation and resources and collaborate with peers. Researchers like Žuvić-Butorac, Roncevic, Nemcanin, and Nebic (2011) concluded that the impact of the use of multimedia is low, through the use of multimedia, the offering of the self-assessment tests, accessibility of digital literature and collaborative activities. As explained further, students value the comprehensiveness, organization, and design of educational materials and teachers' online engagement especially in the good management of e-course. Continuous and careful monitoring of learner's satisfaction will ensure success for the feasibility and viability of online teaching. The station rotation model of instruction systems changes the way the learners learn and also changes the way the teachers teach, students have access to more activities, learn through teacher-led instruction, collaborate with peers, and have access to a computer with the internet.

**Figure 1**

*Rotation station model configuration of instruction*



Sands (2017) emphasized that the rotation model improves flexibility and customization which makes the learning enjoyable and engaging. With the station rotation model of instruction, flexibility is allowed in the grouping, slow learners enjoy more time and attention of the teacher, each student has direct attention of the teacher and it allows students to use technology's different applications and be more creative. Sands (2017) further identified the following as some of the benefits of using station rotation: unparalleled flexibility, modern learning approach, customized

and personalized content, and engaging for all. The station rotation model of instruction can work for students of any age and level, every subject can also be taught using a station rotation model. Communication, collaboration, critical thinking, and creative problem-solving are embedded in the station rotation model of instruction.

The station rotation model of learning, if adopted in might make a significant change in the students' academic performance by heightening the interest of the students potentially change their attitude towards the subject matter. Attitude is another important construct in learning.

## **Attitude**

The learners' attitude can play a significant role in effective learning of a subject like mathematics. Students' achievement in mathematics is not only affected by cognitive factors, but affective variables like attitude, beliefs, and motivation also have impacts (Zan, Brown, Evans, & Hannula, 2006). Attitude is a positive or negative disposition towards learning (Zan & di Martino, 2007). If the students have a positive or affinity to learn mathematics, the effect can be positive on students' performance while the negative feelings might affect the performance negatively. Agoro, Akinoso, Oyediran, and Olafare (2017) posited that attitude, as a learned predisposition of the individual, caused a positive or negative response to the situation, object, and concept which in turn, plays a pretentious role in determining the individual reaction to a specific entity. Lipnevich, MacCann, Krumm, Burrus and Roberts, (2011) averred that the more positive students' attitudes towards a subject, the stronger the intention to perform well.

Students' attitudes towards mathematics as reported by Chagwiza, Mutambara, Tatira, and Nyaumwe, (2013), correlated with achievements in mathematics and as an important predictive factor for achievement. Akinoso and Adeniyi (2019), in a study of effectiveness and attitude of students toward e-courses at the University of Lagos, concluded that students have a positive attitude towards e-courses. Similarly, Mohd, Mahmood and Ismail (2011) found a positive relationship between students' attitude and their achievement in mathematics. Rosas et al. (2003) concluded that through the use of technologies in the classroom, there is evidence of a relationship among computer-supported recreational activities, positive attitudes towards mathematics, improvement in mathematical learning, and student performance. Akinoso, (2018), studying the effect of the use of multimedia on students' performance in secondary school mathematics concluded that the academic performance of students in mathematics was positively influenced by the use of multimedia.

As important as attitude is in learning, the teachers' attitude to teaching can also influence the students' attitude toward learning. Ngeche (2017) submitted that a connection exists between teachers' and learners' attitudes, and performance. If a mathematics teacher is indulgent, ready to listen to learners' contributions, correct learners' mistakes without abusive or insulting language, and devoted to teaching, they can have a positive effect on learners' attitudes to learning. Ngeche emphasized that teachers are to provide support, encourage students to eliminate learners'

unwanted behaviour. Ngeche also averred that a teacher's attitude towards mathematics can be measured by the emotional response to mathematics (affective), beliefs about Mathematics (cognitive), and the teacher's behaviour. Yara, (2009) asserted that many teachers rarely realize the manner in which they teach, behave and interact with learners can influence learning more than their mastery of the subject matter. This shows the importance of teachers' attitude to the learners' attitude and achievement, especially in mathematics.

### **Statement of the Problem**

Mathematics is essential in many aspects of life. In education, the teaching and learning of this subject should be given proper attention to improving students' performance. Most of the learners still struggle to learn mathematics. Thus, there is the suspicion that delivery methods and strategies might be, fundamentally, the issues to the poor performance of students in mathematics and mathematics-related subjects. Action learning and concept motivation was suggested while learning mathematics to reduce to minimal level the poor performance (Abramovich, Grinshpan & Milligan, 2019). The study, therefore, investigated the effect of the station rotation model of instructional delivery on students' achievement and attitude in senior secondary school mathematics.

### **Research Questions**

The following research questions were posed:

1. What is the achievement of students taught mathematics with the station rotation model of instruction compared with students taught with another conventional method?
2. What is the attitude of students taught mathematics with the station rotation model of instruction compared with students taught with another conventional method?

**Hypotheses.** The following null hypotheses were measured at 0.05 level of significance

HO<sub>1</sub>: There is no significant difference between the achievement of students taught mathematics with Station Rotation Model and students taught with conventional method.

HO<sub>2</sub>: There is no significant difference between the attitude of students taught mathematics with the Station Rotation Model and students taught with conventional method.

### **Methodology**

#### *Participants*

A multistage sampling technique was used to select a sample for this study. Educational District IV was selected randomly from the six educational districts in Lagos State in Nigeria. Two schools used for this study have well equipped computer laboratory and mathematics teachers are highly competent in the use of computer for instructional delivery. One intact class was selected each

from the two schools, and these schools were randomly assigned to experimental and control. The total number of students in the study is 120. Sixty-one of the participants were taught using the station rotation method, using the school's mini hall to provide sufficient space to do so. The other 59 participants were instructed using the traditional classroom methodologies generally found at the school.

### *Design*

This study adopted a pretest, posttest, control group quasi-experimental design. The students in the experimental group were taught with a station rotation model of instruction. In the station rotation model, the students moved through three distinct types of instruction in turn: 1) teacher-led instruction in which the teacher introduced and explained the concept thoroughly; 2) collaborative activities stage in which the group came together and discussed what the teacher taught them at the teacher-led stage and 3) online instruction stage where the students were provided with the necessary technology-related tools (i.e. URL, downloaded video or specific website) for the topic. The control group followed the traditional classroom method of teaching found at the school. The topic of study for both groups was angle of elevation and depression taught for four weeks of three periods of forty-five minutes each.

The instruments used for data collection were the Mathematics Achievement Test (MAT) which consists of 25 questions taken from West African Examination Councils (WAEC) standard questions and the Attitude towards Mathematics Inventory (ATMI) adapted from Tapia and Marsh (2004) which consists information about self-confidence, the value of mathematics, enjoyment of mathematics and motivation. Both instruments were validated. The reliability coefficient of MAT was 0.85 using Kuder Richardson's formula 20 (KR-20), while the ATMI had a reliability coefficient alpha of 0.97 which was recommended for investigating attitudes of students towards mathematics. The pretest was administered one week before the treatment and the posttest one week after the treatment for both groups, the study lasted for six weeks. Data collected were analyzed using the descriptive and inferential statistics of mean and Analysis of Covariance respectively on Statistical Package for the Social Sciences (SPSS) version 20.

## **Results**

**Research Question 1.** What is the achievement of students taught mathematics with the station rotation model of instruction compared with students taught with the conventional method?

The data presented in Table 1 shows that the treatment group taught mathematics with a station rotation model of instruction had a mean score of 13.90 on the pretest and a mean score of 65.25 on the posttest, showing a mean gain of 51.35. The control group taught with conventional methods had a mean score of 18.13 in the pretest and a posttest mean of 59.29 with a pretest, posttest mean gain of 41.16. With these results, students taught mathematics with station rotation

had a higher mean achievement score than those taught with a conventional method.

**Table 1**

*Mean of Pretest and Posttest Scores of Treatment Groups taught Mathematics with Station Rotation Model and Conventional Method*

| Techniques          | N  | Pretest<br>$\bar{X}_1$ | Posttest<br>$\bar{X}_2$ | Mean Gain |
|---------------------|----|------------------------|-------------------------|-----------|
| Station Rotation    | 61 | 13.90                  | 65.25                   | 51.35     |
| Conventional Method | 59 | 18.13                  | 59.29                   | 41.16     |

**Research Question 2.** What is the attitude of students' taught mathematics with the station rotation model of instruction compared with students taught with another conventional method?

Table 2 shows that the treatment group had a mean attitude score of 84.87 on the pretest and a mean attitude score of 91.87 on the posttest, making a mean attitude gain of 7.00. The control group had a mean attitude score of 85.01 on the pretest and a posttest mean attitude score of 91.23, showing a mean attitude gain of 6.22. With these results, students taught mathematics with station rotation had a higher mean attitude score than those taught with conventional methods.

**Table 2**

*Mean Attitude of Pretest and Posttest Scores of Treatment Groups taught Mathematics with Station Rotation Model and Conventional Method*

| Techniques          | N  | Pretest<br>$\bar{X}_1$ | Posttest<br>$\bar{X}_2$ | Mean Gain |
|---------------------|----|------------------------|-------------------------|-----------|
| Station Rotation    | 61 | 84.87                  | 91.87                   | 7.00      |
| Conventional Method | 59 | 85.01                  | 91.23                   | 6.22      |

The result showed that there was not statistically significant difference for either the first research questions, which leads us to accept the null hypotheses for both questions.

The data presented in Table 3 shows F-calculated values for the group (station rotation and conventional) on students' achievement and attitude to mathematics. The F-calculated value for the group is 64.253 with a significance of F at .000 which is less than 0.05. The null-hypothesis one is therefore rejected at 0.05 level of significance. With this result, there was a significant difference between the achievement of students taught mathematics with a station rotation model of instruction and those taught with the conventional method. The F-calculated value for attitude is 124.216 with a significance of F at 0.060 which is greater than 0.05. This indicates that there was no significant between the attitude of students taught mathematics with the station rotation model of instruction and those taught with the conventional method. Therefore, the null hypothesis two was not rejected at 0.05 level of significance.

**Table 3**

*Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Treatments (Station Rotation) and Attitude on Students' Achievement in Mathematics*

| Source          | Sum of Squares        | Df  | Mean Square | F        | Sig. |
|-----------------|-----------------------|-----|-------------|----------|------|
| Corrected Model | 2299.756 <sup>a</sup> | 2   | 514.939     | 87.476   | .000 |
| Intercept       | 15844.331             | 1   | 15832.331   | 2.411E3  | .000 |
| Pretest         | 59.814                | 1   | 59.814      | 9.101    | .003 |
| Group           | 435.452               | 1   | 425.452     | 64.253*  | .000 |
| Attitude        | 882.469               | 1   | 812.469     | 124.216* | .060 |
| Error           | 861.001               | 117 | 6.573       |          |      |
| Total           | 532787.000            | 120 |             |          |      |
| Corrected Total | 3160.757              | 119 |             |          |      |

Notes. \*Significant at sig of  $F < .05$

## Discussion

The results of this study showed that students taught mathematics with station rotation had a higher mean achievement score than those taught with the conventional method. Also, a significant difference existed in achievement between students taught with a station rotation model of instruction compare with those in the conventional method of teaching in mathematics. In the station rotation model of the instruction group, there existed interaction and active learning which allowed students to use more senses. The different stages used in station rotation allowed students to interact with their colleagues, and the technology tools which allow manipulation of some of the materials which boost the interest of the students towards the learning of mathematics. This kind of interaction with involvement of the learners in learning has a positive effect on students' results in mathematics. Although, there are interaction in conventional method, the results suggest that they may not be as effective as the one in station rotation due to the structured stages used throughout instruction.

The results suggest that learners in the treatment group could recall material more effective due to a greater sense of learning than happened in the control group. This result corroborated the results from Akinoso's (2018) study that concluded that the academic performance of students in mathematics was positively influenced by multimedia. The results also negate the findings of Žuvić-Butorac, Roncevic, Nemcanin and Nebic (2011) who reported that the lower level of agreement was obtained on the use of multimedia, self-assessment tests, accessibility of digital literature and collaborative activities. The station rotation included the use of technology that potentially contributes to the performance of students in mathematics.

It was also discovered that students taught mathematics with station rotation had a higher mean attitude score than those taught with the conventional method. However, the difference in

the mean attitude of both groups was not significant. This implied that the attitude of the student towards learning does not change but remained the same with the use of the station rotation model of instruction as well as a conventional teaching method. Although previous studies (Akinoso & Adeniyi 2019; Chagwiza, Mutambara, Tatira, & Nyaumwe, 2013; Mohd, Mahmood, & Ismail, 2011) concluded that students have a positive attitude towards learning mathematics through technology, the findings of this study suggested that the use of technology in the station rotation did not change the attitude of students about mathematics. One reason might have been the already frequent use of technology in the lives of the participants, leading them not to think that technology in learning as being special or different.

## **Conclusion**

It was discovered and concluded from this study that the station rotation model of instruction improved the learning of mathematics, and; therefore, represented an effective teaching approach for mathematics. The use of a station rotation model of instruction in teaching can improve students' achievement in learning. It is activity-based and interactive way of teaching which creates one-to-one interaction with the teacher. However, it was also concluded that the use of the station rotation model of instruction did not change the students' attitudes toward the learning of mathematics.

## **Recommendations**

Based on the findings and conclusion above, the following recommendations were suggested:

1. Special training programs should be arranged for the teachers on the use of computers and teachers should develop the skills in the use of the internet and how to use the station rotation model of instruction while teaching. This will help improve the teaching and learning of mathematics and improve the learning of sciences which will bring out more benefits in this era of advancing technology.
2. Although the current study did not bear this out, others have suggested that mathematics teachers should learn about more strategies that can change the negative attitude of some students to positive to improve their interest in the subject.
3. The stakeholders in the education sector should make available the facilities needed for the effective use of online learning.
4. This study was limited to the schools with well-equipped and functioning computer laboratory in the selected district, precisely district (IV) in Lagos State. Every school should be provided with functioning computer for effective teaching especially for the use of the methods that involves online teaching.

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# DEVELOPING FURTHER SUPPORT FOR IN-SERVICE TEACHERS' IMPLEMENTATION OF A REASONING-AND-PROVING ACTIVITY AND THEIR IDENTIFICATION OF STUDENTS' LEVEL OF MATHEMATICAL ARGUMENTATION

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## Abstract

This is the third in a series of papers focusing reasoning-and-proving. Participants were in-service teachers enrolled in a continuing university education programme in teaching mathematics for grades 5–10. Data were collected from a course assignment in 2018 and 2019, where the in-service teachers reported about their students' work with a reasoning-and-proving task. Their reports included an identification of the levels the students' written argumentation reached, based on Balacheff's taxonomy of proofs. The course assignment's instructions were expanded for the 2019-cohort. Comparing in-service teachers' proof level identifications to the researchers' by statistical analyses, indicated an improvement of the general quality from 2018 to 2019. A higher consensus in 2019 included identifying generic arguments and an understanding that there might be examples falling outside of the taxonomy levels. Qualitative content analysis of the two cohorts' justifications of their identifications revealed an improved understanding of what is considered generic argumentation. The results encourage and contribute to further developments of the concept.

**Keywords:** Balacheff's four levels of proofs, identification of student arguments, mathematical reasoning-and-proving, written imaginary dialogues

## Introduction

There is a shortage of research regarding how to prepare pre- or in-service teachers in engaging their students in proving activities in primary and lower secondary classroom (Stylianides, 2016). The aim for this paper is to add knowledge to this gap. This is the third paper in a series of papers focusing on studies on teaching of mathematical reasoning-and-proving. The subjects in the papers are in-service teachers (ISTs) from across Norway enrolled in the first term of Year 1 of a continuing university mathematics education for grades 5–10 (students of age 10 to 15) in the national strategy "Competence for Quality". ISTs in the online programme prepared and implemented a reasoning-and-proving task to their students. The mathematical problem was presented for the students as a dialogue, where two fictitious pupils already had taken the initial steps in discussing the task. Pairs of students were to continue the dialogue and put their arguments in writing. ISTs approached students' mathematical thinking processes in their imaginary dialogues (Wille, 2017) and analysed students' written arguments based on Balacheff's (1988) taxonomy of proofs, which classifies four hierarchical levels of thinking: naïve empiricism,

crucial experiment, generic example, thought experiment.

Each study in this series explored the combination of a mathematical task, the method of imaginary dialogues, and a taxonomy for analysis. The first study (Brodahl & Wathne, 2018), drawn on 2016-participants, investigated perceptions of first experiences with the complex combination as a whole, the second (Wathne & Brodahl, 2019), drawn on 2017-participants, the usefulness of the particular method and taxonomy, as perceived by the teachers. The current study of participants from 2018 and 2019 is independent from the previous two studies. It focused on the quality of ISTs' proof level identifications and the impact of expanding instructions for the 2019-cohort with a preparation brief on possible pitfalls in proof level identifications.

When we assessed the project reports from 2018, we noticed shortcomings in the proof level identifications made by ISTs. These observations resulted in a development of the task instructions for the course in 2019. We briefed on potential pitfalls and added a short video to support ISTs in their work. When assessing the reports from 2019, our impression was that the quality of the ISTs' proof level identifications had improved. However, that notion raised an important issue: How could we know that there really was any improvement of quality of the identifications? That issue led us to the first research question of this paper.

On average, 90.5% of ISTs from the 2018 and 2019 cohorts perceived Balacheff's taxonomy for classifying levels of proofs to be useful; whereas 54.1% perceived challenges in identifying proof levels in their students' written dialogues, and 59.5% found explaining their identifications to be challenging. Because it is important to distinguish invalid and valid proof argumentation in primary and lower secondary school (Ministry of Education and Research, 2020; Stylianides, 2016), these ISTs' perceptions indicated the understanding of what counts as a valid proof might need to be improved. Thus, as teacher educators, we concluded that we needed to know how to better facilitate ISTs in identifying the third level in Balacheff's taxonomy, the generic example. This insight could, in turn, help teacher educators in improving their instructions when adapting the concept 'a task, a method and a taxonomy' to develop ISTs' proficiency of teaching reasoning-and-proving. This issue led us to the second research question of this paper.

Subsequently, we developed the following research questions:

1. How did the quality of in-service teachers' proof level identifications of their students' work with a reasoning-and-proving task change from 2018 to 2019?
2. What justifications do in-service teachers suggest when they incorrectly identify the proof level "the generic example" in students' reasoning and proving?

The paper describes two trails associated with the two research questions. The first research question in this observational study was treated as well by a statistical approach to examine if there existed a change in the quality of the identifications, as by a qualitative approach to describe some of these changes. The second research question was explored by a qualitative content analysis.

## Theoretical considerations

This study investigated how ISTs identified their students' mathematical arguments used in a reasoning-and-proving process. The definition of "proof" and conceptualisation of the meaning of proof in school mathematics that guided the current study, come from A. Stylianides (2007): "*Proof is a mathematical argument, a connected sequence of assertions for and against a mathematical claim*" (p. 291). The argumentation uses statements accepted by the classroom community and forms of reasoning and communication known by or within the conceptual reach of the classroom community.

The study followed G. Stylianides (2008) using the term "reasoning-and-proving" to encompass the breadth of the activity associated with identifying patterns, making conjectures, providing proofs, and providing non-proof arguments (p. 9). His analytical framework (p. 10) captures activities involved in reasoning-and-proving. Four of them are identified in Balacheff's (1988) taxonomy of proofs and used to categorise different levels of mathematical arguments: "naïve empiricism", "crucial experiment", "generic example" and "thought experiment" (p. 218).

The terms naïve empiricism and crucial experiment are acknowledged as special kinds of empirical arguments for or against a mathematical claim, as example-based reasoning, but not as valid proofs. Due to the taxonomy, only level 4 counts as a rigorous proof, although even level 3 requires general argumentation similar to a formal proof. A generic example is in terms of A. Stylianides' (2007) proof definition, a valid mode of proving a conjecture, using a particular case seen as representative of the general case, while thought experiment constitutes formally established modes of mathematical proof.

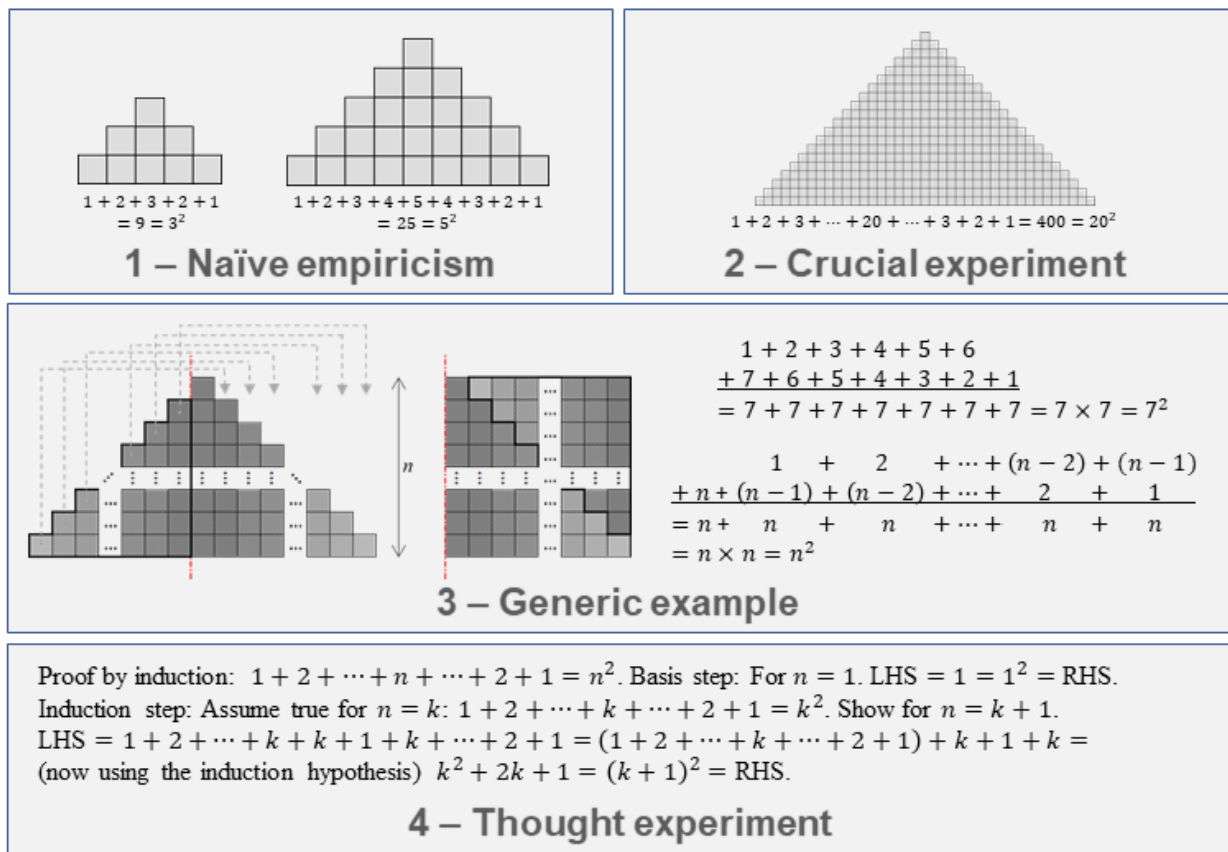
The current study drew on ISTs' application of Balacheff's taxonomy of mathematical proofs to identify how far the students' argumentation reached on their way to a valid proof of a mathematical conjecture. Using the same conjecture as in the course assignment, Figure 1 illustrates examples of elements to be considered. The conjecture was to argue that there are  $n^2$  blocks in an  $n$  step up-and-down staircase.

Stylianides and Stylianides (2009) regarded the particular case, chosen as a generic example, to illustrate a prototype offering conclusive evidence for the truth of a mathematical generalisation. Because all cases are considered when a particular case is used as representative of the general case, such cases do not have empirical status (p. 315). However, there are subjective aspects "to the acceptance of a generic proof as a proof, even within the same community of observers" (Zaslavsky, 2018, p. 295) and little consensus in literature on what constitutes a generic example (Doğan, 2020; Rø & Arnesen, 2020). Reid and Vargas (2018) suggested that generic examples in written work of students can be considered as both generic and empirical, depending on the reader's reasoning and reconstruction, and what is accepted within a certain community. They claimed two criteria for valid generic arguments: the evidence of awareness of generality, and the mathematical evidence of reasoning (p. 17). Rø and Arnesen (2020) expanded these claims

for examples providing a proof, that respectively “the argument concludes with the general claim that was to be proved”, and “the argument contains both a mathematical reasoning concerning the example [...], as well as an explicit lifting of this reasoning to the general case” (p. 3).

**Figure 1**

*Glimpses of arguments for the conjecture “There are  $n^2$  blocks in an  $n$  step up-and-down staircase built from blocks”, considered categorised according to the levels of Balacheff’s (1988) taxonomy of proofs*



In this paper, we followed A. Stylianides (2016) and other researchers (e.g. Rowland, 1998; G. Stylianides, 2008) regarding the strength and importance of the generic example in education, to lay in its potential as a didactic tool in school at all levels, as this level of abstraction is in accessible reach. The generic example was seen to help students discover the general in the particular and having the power to convince, as well as explain, and serve both as a mean in itself and supplying a mean to bridge the gap between informal arguments and more formal proof (Rø & Arnesen, 2020).

## Methods

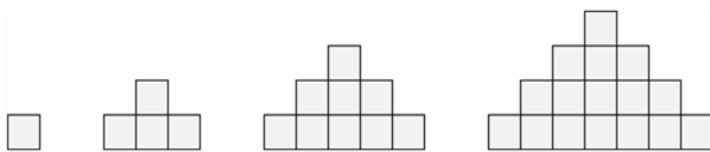
Our two research questions were partly explored by different methods. In this section, we present methods common for both research questions: the setting for this study, the sample, the analytic tool used to describe which proof levels were presents in the dialogues, and how this

analytic tool was employed to generate data. To facilitate the reading, analysis methods used in one trail of the investigation only, will be presented in the results section.

The data in this study came from a mandatory course assignment: IST should prepare and implement a reasoning-and-proving task to their students, with the mathematical problem presented as a dialogue between two fictitious pupils. The mathematical problem was about how to find the number of blocks in a specific pattern (Figure 2). The direct way is to add the number of blocks in each row or column, but the fictitious pupils in the initial dialogue “building up-and-down staircases” (<http://bit.ly/buildingupanddownstaircases>) suggest that a quicker way to find the number of blocks is by computing the square of the figure’s number.

**Figure 2**

*Up-and-down staircases built from blocks*



The students’ task was to continue the imaginary dialogue and prove that the square will always give the correct result. After the session, ISTs wrote a report, including three continuing dialogues produced by their students, followed by an identification of the levels of the mathematical argumentation in these dialogues, based on Balacheff’s taxonomy of proofs. Our primary data consisted of the students’ written argumentation, and ISTs’ identifications of proof levels including justifications of their choices.

The study drew on the project reports from all ISTs from the cohorts in 2018 and 2019, who gave their informed consent to participate. Excluding reports from ISTs’ teaching classes for non-Norwegian speakers gave 37 participants (out of 56) from the 2018 cohort (aged 27 to 55), and 31 participants (out of 48) from the 2019 cohort (aged 28 to 54). Their classes ranged in 2018 from grade 4 to 11 (age 9 to 16), and in 2019 from grade 5 to 11.

After excluding reports where students’ argumentations were not presented as dialogues, the remaining 186 dialogues and the corresponding identifications constituted our sample. In 2018, there were 33 dialogues from primary school, 65 from lower secondary, and 3 from first year at upper secondary level. The corresponding numbers from 2019 were 21, 61 and 3. All project reports were anonymised before analysis.

The reports should include which Balacheff levels ISTs identified in each dialogue, and a justification for their decision. In our analysis, we categorised these texts written by ISTs by marking which of Balacheff’s levels we interpreted ISTs had identified. However, we found the four levels of Balacheff’s taxonomy to fall short, for example when an IST reported “the students have started a reasoning towards level 3, but they are not close to finishing their proof”. We found it unsatisfactory either to mark level 3, or to not at all expose that IST had identified some reasoning at this level. Hence, we developed an analytic tool, which also included precursors for

each of the four levels in Balacheff's taxonomy. In addition, there were dialogues falling outside of Balacheff's taxonomy, as no argumentation for the validity of the suggested formula existed. We chose to identify such dialogues as 'category 0.'

Thus, our analytic tool consisted of nine categories, 0, p1, 1, p2, 2, p3, 3, p4 and 4. The prefix p indicated the precursor for the numbered levels. Category 0 was used for argumentations falling outside of Balacheff's taxonomy and constituted the only category that cannot be combined with any other category. Arguments categorised as p1 comprise students giving a single example with few blocks and showing that  $n^2$  gives the right number. Argumentation categorised as category 1 (identical to Balacheff's level 1 – naïve empiricism) meant the students showed that  $n^2$  gives the correct number of blocks for a few examples. Examples of p2 comprise students showing that  $n^2$  works for several examples, but they did not try an example where the number of blocks was distinctly higher than in the other examples. Category 2 (crucial experiment) meant the students showed that  $n^2$  will give the correct number for a staircase with many blocks. That is, the students became convinced of the validity of the formula, by applying it on a more advanced example. Arguments in category p3 comprise students for specific examples claiming the staircase can be rearranged to a square, but not arguing for why this is always possible. An argumentation where the students, in addition, showed that every staircase can be rearranged as a square, was identified as category 3 (generic example). Arguments in category p4 comprise starting an algebraic proof, but not finishing. Category 4 (thought experiment) would usually be a complete proof. In this task, that would be likely to be a proof by induction. Overall, one dialogue might contain arguments on more than one category, however a level and its precursor exclude each other.

The 186 dialogues were scrutinized by three researchers, first individually, and then together to agree on which categories ISTs had identified. In addition, these three researchers made their own analysis on which categories were present in these dialogues, independently of what categories ISTs had identified. The identifications made by ISTs and by the researchers were then compared for each dialogue. This was made to investigate how the disagreement changed from 2018 to 2019.

## Results

We will present the results in two subsections, one for each research question. In each subsection, we will explain the analysis methods used to answer the corresponding research question only.

### *The Quality of ISTs' Identifications of Categories*

In this subsection, we present results regarding how well ISTs succeeded in their identifications of Balacheff's levels in students' argumentation. The quality was measured through comparisons between ISTs' and the researchers' identifications, first on the whole dataset,

then on dialogues where ISTs identified any generic argument (category p3 or 3). We chose to focus on these categories, because reasoning-and-proving at a general level is important for students' learning (Rowland, 1998; Rø & Arnesen, 2020; A. Stylianides, 2016; G. Stylianides, 2008), as well as a core element in the syllabus for compulsory school in Norway (Ministry of Education and Research, 2020). The notion of 'disagreement' between ISTs and the researchers, was central in our comparisons and connected to the notion of 'quality' of ISTs' identifications. Disagreement described differences in the identifications of categories due to our analytic tool. We used the researchers' agreed identification of categories as a unanimous conclusion and treated it as the correct solution. Thus, low disagreement between the IST's and the researchers' identifications on a dialogue was equivalent to high quality of that IST's identifications. At the end of this subsection, we also explore ISTs' use, or rather lack of use, of category 0, that is the category for dialogues falling outside of Balacheff's taxonomy.

**Comparison of all dialogues.** We constructed an algorithm to measure the disagreement between ISTs and the researchers for each dialogue in the cohorts 2018 and 2019. The algorithm has three different types of disagreement, named A, B and C, graded from minor (A) to major (C). The algorithm does not distinguish whether it was the IST or the researchers who identified a category, only that the other had not. Thus, in the following explanation of types of disagreement, IST and the researchers can always be swapped.

Disagreement A is disagreement inside one of Balacheff's levels (e.g. IST identified 1 and the researchers identified p1). In dialogue 1 in Table 2, there is one disagreement of type A.

Disagreement B is applied for disagreements between Balacheff's levels 1 and 2 (e.g. IST identified p2, and the researchers identified 1) as in dialogue 2 in Table 2. That gives two disagreements of type B, since each identified a category that the other did not. If IST identified categories 1 and 2, and the researchers identified 1, as in dialogue 3, then both agreed on category 1. The only disagreement is that Identification I included 2, which means one disagreement B.

Disagreement C is any other disagreement between categories (e.g. IST identified 3 and the researchers neither p3 nor 3). In dialogue 1, category 3 has no equivalent in Identification II, which gives one disagreement C. Notice that the categories at Balacheff's levels 1 and 2 also can generate disagreements of type C. If IST identified category 2, that means disagreement C if the researchers did not identify any of the categories at level 1 or 2. Only if the researchers identified p1 or 1, that IST's identification of category 2 would change to disagreement B.

It remained to decide what coefficients to assign the three types of disagreement. Our choice was to let  $A = 0.5$ ,  $B = 0.7$  and  $C = 1.5$ , based on that type C by far is the most serious disagreement, and that two disagreements of type B should be less serious than one of type C. For each dialogue, the total disagreement between IST and the researchers is obtained by adding all coefficients connected to the types of disagreements identified.

Table 1 demonstrates how to apply this algorithm. For example, in dialogue 1, there is one

disagreement of type A and one of type C, which means the measure of the disagreement is  $0.5 + 1.5 = 2.0$ .

**Table 1**

*Examples of measuring disagreements*

| Dialogue | Identification |    | Disagreement |       |
|----------|----------------|----|--------------|-------|
|          | I              | II | ABC          | Value |
| 1        | 1, 3           | p1 | 1A+1C        | 2.0   |
| 2        | 2              | p1 | 2B           | 1.4   |
| 3        | 1, 2           | 1  | 1B           | 0.7   |
| 4        | 3              | p3 | 1A           | 0.5   |
| 5        | 1, 2, 3        | 2  | 1B+1C        | 2.2   |

*Note.* Comparison of identifications for dialogues. Identifications consist of categories checked. Disagreement is calculated for  $A = 0.5$ ,  $B = 0.7$  and  $C = 1.5$ .

By using this algorithm, each of the 101 dialogues from 2018 and the 85 from 2019 got a measure of the disagreement between IST and the researchers. Our hypothesis, based on our first impression, was that the disagreement had decreased from 2018 to 2019. A comparison of the mean values of the disagreement suggested this to be true. The mean value decreased from 2.009 to 1.735. However, a t-test showed this change not to be significant ( $p = 0.0975 > 0.05$ ). This meant, we could not surely conclude that the decrease was likely to be because of improvement in the ISTs' identifications.

To point at statistical significance would have been a strength in our claim that the quality of ISTs' identifications was higher in 2019. Despite the fact that the data indicated this endeavour failed, our impression was that there still existed an improvement, evidenced by the qualitative data; hence, we will now focus on these dialogues identified as category p3 or 3 by ISTs. Since reasoning at a general level is of special importance (cf. Rowland, 1998; Rø & Arnesen, 2020; A. Stylianides, 2016; G. Stylianides, 2008), our impression might be connected to identifications at this level.

**Comparisons of dialogues identified as category p3 or 3.** When this study was conducted, one core element in the forthcoming mathematics syllabus for grades 1–10 was “reasoning and argumentation” (Ministry of Education and Research, 2020). Arguments at the highest level in Balacheff's taxonomy (thought experiment) require an algebraic approach and may not be expected as common from students in compulsory school. Hence, it was plausible that ISTs and their students aimed for arguments at level 3 (generic example). Thus, we found it relevant to explore project reports where IST had identified categories p3 or 3 in their students' written dialogues. This could increase our knowledge of if the students actually reached p3 or 3, or if the identification made by IST was incorrect, and in that case what justification they provided. That would support us in further developments of the task instructions for future cohorts.

There were 37 dialogues in the 2018 cohort, where ISTs identified either p3 or 3. In 2019, 29 dialogues were identified as p3 or 3. The researchers identified category p3 in 42 of these 66 dialogues, and they did not identify any of these dialogues to fully reach category 3.

We divided the 66 dialogues into three groups, based on type of agreement between IST and the researchers. The first group consisted of dialogues of total disagreement, where IST had identified either p3 or 3, while the researchers had not. The second group consisted of dialogues of total agreement, where both IST and the researchers had identified p3. The third group consisted of “partial agreement”, where IST had identified 3 and the researchers p3. The distribution between these groups is shown in Table 2.

**Table 2**

*Comparison of identifications of p3 or 3*

| Dialogue          | 2018     |     | 2019     |     |
|-------------------|----------|-----|----------|-----|
|                   | <i>n</i> | %   | <i>n</i> | %   |
| Disagreement      | 18       | 49  | 6        | 21  |
| Agreement         | 8        | 22  | 14       | 48  |
| Partial agreement | 11       | 30  | 9        | 31  |
| Total             | 37       | 100 | 29       | 100 |

*Note.* Frequency of dialogues identified as category p3 or 3 by IST.

The group of total disagreement decreased from 49% to 21%, between 2018 and 2019, while the group of total agreement increased from 22% to 48%. This finding indicated an improved quality of the identifications between 2018 and 2019. A  $\chi^2$ -test indicated this change to be significant ( $p < 0.05$ ).

This improvement remained, when we for the same 66 dialogues included all categories identified by ISTs and the researchers, respectively. When applying the algorithm for measuring disagreement, the mean value of the disagreements decreased from 2.281 in 2018, to 1.721 in 2019. A t-test showed this change to be significant ( $p < 0.05$ ).

**Identifications of category 0.** We close the subsection dealing with research question 1, by highlighting the employment of category 0. In 2018, we discerned dialogues that did not deal with the task, which was to prove that the number of blocks for staircase  $n$  can be calculated by the ‘formula’  $n^2$ . Such dialogues, or dialogues without any relevant argumentation for the validity of the formula, fall outside Balacheff’s taxonomy, that is category 0 in our analytic tool. In 2018, no dialogue was identified as category 0 by the ISTs, while the researchers identified 32 dialogues as category 0. This difference indicated a lack of understanding of Balacheff’s taxonomy by ISTs.

For the 2019 cohort, the task instructions were improved, stressing that a dialogue may fall outside the four Balacheff levels. This resulted in a modest improvement. The 2019 ISTs identified five dialogues as category 0, while the researchers identified 23.

### *ISTs' justifications of their identifications*

In this subsection, we focus the 24 dialogues where ISTs identified either category p3 or 3, the researchers neither nor. We explore what justifications ISTs suggested when they incorrectly identified these categories. Qualitative content analysis was used to highlight underlying themes in their justifications, which allowed for the interpretation of textual data through finding and coding themes.

Two researchers independently analyzed and coded this subsample of 24 dialogues. Then, they organized themes and codes in a multifaceted codebook, in an iterative process using inductive and deductive approaches (Bryman, 2012). The process of having two researchers independently perform the coding of data, then compare and align, was used to improve the validity of coding. The outcome was five 'tags', which describe ISTs' justifications of category p3 or 3.

The first tag, 'incorrect employment of category', denoted that ISTs interpreted something as "generic example", although it was not. This suggests ISTs had not understood what a generic example is. One example was the IST that wrote "This group is at level 'generic example', where they with a couple of simple examples show the solution to be true. They have given a general formula, answer = steps · steps." Another example was "I mean that the dialogue and the proving is at level 2 'crucial experiment' since she uses higher numbers for testing, and that she actually approaches level 3 based on what she says regarding that it is valid for all figure numbers." In these two dialogues, ISTs used incorrect arguments for that the dialogues include generic examples.

The second tag was 'any figure used as warrant of p3 or 3'. Two examples were when IST wrote "Further, the students tried manipulatives, they drew a figure of the 'steps.' The students then applied the 'generic example'..." and when IST wrote "This is a generic example, since it has a figure in addition to the calculation." In these dialogues, the students had drawn just one or several pictures of a staircase, with no signs of rearranging the blocks into a square. This tag can be seen as a 'subtag' of the previous ('incorrect employment of category'). However, the researchers found this misunderstanding to be of such importance that it should be a tag of its own.

The third tag, 'conjecture is used as argument', can also be seen as a subtag of the first. One example was "Then he concludes that the formula is  $x \cdot x$  and says he does not understand why. Here, I think he is searching for a generic justification." A second example was "The dialogue is due to Balacheff in 'generic example', since the students are aware of the relation and from this were able to construct a formula to solve the task generally." This meant no proof existed, but the construction or usage of the relation to be proved was interpreted as a generic example.

The fourth tag was 'wishful thinking'. This could be when ISTs used reasoning that was not in the written dialogue, for instance IST had heard the students discussing the point. The last

tag was ‘doubtful.’ This was used when ISTs clearly expressed that they did not know if this really was any of category p3 or 3.

Table 3 shows the frequencies of these tags in ISTs’ justifications. Note that more than one tag might be present in the same justification.

**Table 3**

*Tags frequency dispersion*

| Tags                                     | 2018 <sup>a</sup> | 2019 <sup>b</sup> |
|------------------------------------------|-------------------|-------------------|
| 1. Incorrect employment of category      | 7                 | 5                 |
| 2. Any figure used as warrant of p3 or 3 | 4                 | 0                 |
| 3. Conjecture used as argument           | 8                 | 2                 |
| 4. Wishful thinking                      | 3                 | 0                 |
| 5. Doubtful                              | 3                 | 3                 |

*Note.* <sup>a</sup>N=18. <sup>b</sup>N=6. Dialogues identified as category p3 or 3 by IST, where the researchers disagreed.

The most frequent tag was ‘incorrect employment of category’, where seven dialogues in 2018 and five dialogues in 2019 were categorised. The second most frequent was ‘conjecture used as argument’, with eight and two dialogues, respectively. For ‘any figure used as warrant for p3 or 3’ the number decreased from four dialogues in 2018 to zero in 2019. This indicated an improvement from 2018 to 2019 regarding ISTs incorrectly justifying category p3 or 3 with ‘conjecture used as argument’ and, in certain, ‘any figure used as warrant of p3 or 3’, while no clear improvement could be discerned for ‘incorrect employment of category’.

## Limitations

Limitations of this study are mainly related to the small sample size and how to measure disagreement between IST and the researchers. When we scrutinised ‘the quality’ of ISTs’ identifications, we used our own identifications as a benchmark, highly aware there were no truly unambiguous ‘correct’ identification of the level of an argumentation (Zaslavsky, 2018), including our own. Although this is a potential concern, we presume that we as researchers can produce identifications that are ‘good enough’ to use as reference.

Even if one agrees on using the researchers’ identifications as references, another concern was how to measure the disagreement between ISTs and the researchers. It can be argued both for and against the algorithm employed. Even if we regarded the algorithm as appropriate, we do not claim it is fully developed. For example, the values of the coefficients A, B and C can be changed. Considering changes in the algorithm might be relevant in future, similar investigations. We will, however, not further discuss that issue in this paper.

## Discussion and Implications

Our first research question was: ‘How did the quality of in-service teachers’ proof level identifications of their students’ work with a reasoning-and-proving task change from 2018 to 2019?’ The findings from our quantitative exploration of ISTs’ identifications of proof levels briefly suggested there has been an improvement of the general quality from 2018 to 2019. However, this improvement was not significant for the entire sample of 186 dialogues and the corresponding identifications. Thus, we cannot present an unambiguous result that shows the general quality of ISTs’ identifications did improve. We could, however, determine an improved quality in the subsample of 66 dialogues, where IST identified generic examples or incomplete generic examples. Our exploration showed their identifications to be of significantly higher quality in 2019 than in 2018. Because the assignment and the teaching model were unchanged, this improvement is likely to be related to the further development of the teacher educators’ preparation brief for the 2019-course.

An interesting issue is ISTs identifying Balacheff levels in dialogues where no valid argumentation was present due to the taxonomy. Although a modest improvement of ISTs’ use of category 0 appeared from 2018 to 2019, a large discrepancy to the researchers’ remained. This indicates a potential for further improvement of future task instructions, so it becomes clear that not every argumentation is captured by the four Balacheff levels. Although we found the results from our first research question useful, results related to our second research question might be more gainful for future teaching.

This question was: ‘What justifications do in-service teachers suggest when they incorrectly identify the proof level “the generic example” in students’ reasoning and proving?’ The most frequent tag was ‘Incorrect employment of category’, which shows there is a need to clarify what is required in argumentation to qualify as a generic example. It might, however, be rather difficult to grasp an abstract definition of the generic example and what constitutes a generic example (e.g. Doğan, 2020; Rø & Arnesen, 2020; Zaslavsky, 2018), which is a possible explanation of the rather small change of occurrence between 2018 and 2019. The tags ‘any figure used as warrant of p3 or 3’ and ‘conjecture is used as argument’ are more concrete concepts, although they, too, can be associated with a lack of understanding of the concept of generic example. These tags were clearly less frequent in 2019, which probably was a consequence of the improved instructions. One explanation could be that it was easier for ISTs to grasp instructions aiming to avoid errors spotted by these tags, than to interpret the abstract definition of a generic example, to avoid errors caught by ‘Incorrect employment of category’. Instructions like ‘just drawing some staircases is not enough to qualify as a generic example, it is necessary to show that the blocks can be rearranged to a square too’ and ‘just constructing or using the “formula”  $n^2$  is not enough’, are rather plausible.

These observations will support further development of instructions. For example, there is

still potential for improvement of the general description of the generic example, as well as what argumentation is required to fully qualify as a generic example. A better understanding of Balacheff's taxonomy will not just have the potential to improve the performance in the course assignment, it may also improve ISTs' own teaching about reasoning-and-proving in compulsory school.

Previous research has shown ISTs' knowledge of what counts as a valid proof to be insufficient (cf. Stylianides, 2016). Similar to the findings of Rø and Arnesen (2020), there were ISTs in our study using insufficient justifications for distinguishing empirical examples from generic examples, and complete generic proofs from incomplete. ISTs' insufficient knowledge about generic examples enforces teacher educators to highlight this level of reasoning-and-proving.

Students' stepping through the first two levels of proofs in Balacheff's taxonomy may be of importance for their learning process. However, ISTs need awareness that these steps do not constitute any valid form of proof. While encouraging students when they engage in this type of reasoning-and proving, focus also needs to be given to the difference between empirical and generic argumentation, when aiming to help students step further (Rø & Arnesen, 2020). Since algebraic proofs are beyond the reach of most primary school students, argumentation involving generic examples is of importance in students' learning process about proofs.

## Conclusion

In this paper, we focus on how teacher educators can prepare pre- or in-service teachers to promote their students in proving activities in compulsory school. Our implications are derived from the findings of this study that adapted the concept 'a task, a method and a taxonomy' (Wathne & Brodahl, 2019). The major challenges concern teacher educators' instructions. These instructions should stress the overall awareness of the generality in proofs, and in particular emphasise how to support students in claiming generality in arguments, in order to prevent them from making incomplete generic examples in their writing. Further, the instructions have to guide ISTs in how to properly claim a given student argument to be either a generic or an incomplete generic example, in consideration of the criteria suggested by Reid and Vargas (2018), and Rø and Andersen (2020).

As to our series of studies, the teacher educators' preparations for the next course will utilise the experiences from this study, to enhance the concept and to achieve further progress in reasoning-and-proving for the future cohorts.

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