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Pre-service teachers' preparation program: Is it responsive to the constructivist school curriculum?

Gladys Sunzuma [1*], Nicholas Zezekwa [1], Walter Munakandafa [1]

[1] Bindura University of Science Education, Bindura, ZIMBABWE
***Corresponding Author:** gsunzuma@gmail.com

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ABSTRACT

There seems to be a mismatch between the requirements of schools and how educators are being trained in educator training institutions with regard to the use of constructivist approaches. This article focuses on the degree to which the student teachers were exposed to the constructivist principles during training. The study draws on the experiences of second-year student teachers at one institution in Zimbabwe. Questionnaires and observations were used to collect the data. The findings focused on the four aspects of constructivism: student teachers' level of interaction; involving students in the planning of learning and assessment activities; connecting and applying mathematics and science to the real-life situation; and accommodating students' views. The study might have some implications on educator training institutions program designers and educators especially on the aspect of aligning their teaching approaches to the constructivist approaches as required by the school curriculum. The results of this study can help educators in designing effective professional development courses as well as improvement in instruction and content delivery. The study recommends that student teachers be involved in the planning of content to be taught.

Keywords: constructivism, student teachers, educator, mathematics, science

INTRODUCTION

Fasheh (1983) points out that in developing countries, such as Zimbabwe, mathematics and science subjects are generally imparted to students as a set of procedures and formulas that students have to learn by heart. However, this approach to teaching does not meet the needs of students from different societies; and with reference to Fasheh's (1983) point, it can be deduced that the rationale of teaching in the developing countries is to get good grades in examinations, without considering whether the students understand the content or whether the content is relevant to their daily activities. Boaler (2009) reported that the educator-centered approach to teaching and learning has been ineffective in producing students who are critical thinkers and problem solvers as compared to constructivist approaches.

In Zimbabwe, it was observed by examiners that the students did not have the ability and skills to apply mathematics and science in life (ZIMSEC, 2001). As a result, Zimbabwe's education system was blamed for producing graduates who are not capable of applying the acquired knowledge in everyday life (Nziramasanga, 1999). To be precise, there was non-transferability of acquired knowledge in solving real-life problems. For that reason, the Zimbabwean education system introduced a new secondary school curriculum that is guided by the constructivist perspective that supports students' participation and engagement in teaching and learning activities (ZIMSEC, 2015). According to Mvududu and Thiel-Burgess (2012), constructivism is an educational theory where educators must put into consideration their students' prior knowledge and experiences and guide them to apply that knowledge in real-life situations. Vygotsky (1978), cited in Woolfolk (2010), referred to constructivism as a movement, where construction of knowledge is done by students using their past information in addition to their cultural and background knowledge.

The new curriculum is supported by the ideologies of constructivism that target enhancing students' active involvement and engagement in the teaching and learning process in Zimbabwean schools. All the same, the implementation of the new curricula is affected by several factors. However, in this context it is greatly influenced by the teachers who were trained from various educator training institutions, ranging from colleges to universities in Zimbabwe. Since the new curriculum is underpinned by constructivist perspectives, this study intends to find out how student teachers view their training in line with constructivism principles. The study findings will provide an insight into how teacher training institutions should align their curriculum to the school curriculum. The study was guided by the following research question:

What are the student teachers' classroom experiences in connection to constructivist principles?

CONSTRUCTIVISM

According to Wilding-Martin (2009), constructivism is an ideology that focuses on matters that deal with the geneses and understanding of knowledge. From the original word, to "construct", constructivism is concerned with the formulation of knowledge by students individually (Goldin, 1990). According to Makonye (2013), constructivism epistemology explains the nature of knowledge and how this knowledge is acquired during the teaching and learning process.

The procedures of knowledge formulation entail making sense from practices in terms of prevailing knowledge. Particularly, students connect known patterns of knowledge to new ones and this results in the creation of new knowledge. Constructivism maintains the opinion that students should be actively involved in knowledge construction using previous knowledge information or experiences. Constructivists believe in the students' ability to construct knowledge through interaction with their surroundings (Schunk, 2014). This implies that constructivism has to do with the creation of new ideas that emanate from the students' experiences. Therefore, there is a need for educators to search for tasks that would enable the students to choose a variety of strategies to solve everyday problems with minimum supervision from educators (Woolfolk, 2010). Genuine learning is attained from experiences that stimulate student's inquisitiveness and give them the opportunity to work out their answers.

Researchers such as Ahsan and Smith (2016) and Loyens et al. (2009) pointed out that the major features of constructivism are knowledge construction, collaborative learning, metacognition in learning, and realistic learning activities. Firstly, students are responsible for knowledge construction through the use of prior knowledge using procedures of transforming, discovering, and testing information, and by revisiting procedures that might be irrelevant in their situations. Secondly, the construction of knowledge can be promoted when the students interact with others, acknowledging the idea that social mediation and collaboration are essential in knowledge construction. Thirdly, metacognition (knowing about our thinking) plays a vital function in the teaching and learning process, whereby students preferably gain new knowledge through self-regulated learning. Fourthly, realistic learning tasks, comprising of solving problems that are related to real-life situations that the students would come across in the future and encourage meaningful learning. Thus, the most important idea in constructivism is that students actively construct knowledge in social settings using their past experiences rather than being passive recipients of the information.

In constructivism, knowledge comes from the interactions between students and the environment, as well as with peers and with educators (Tuckman & Monetti, 2011). According to Applefield et al. (2001), constructivism views knowledge construction as the social intersection of people, associations that incorporate sharing, looking at and discourse among the students and the educators. In a constructivism class students are capable of establishing their meanings, whilst assisting others to find meaning. As a result, knowledge is jointly created. This notion has its roots in Vygotsky's (1978) constructivism theory, which focuses on the idea that social interaction facilitates learning, that is, students work together to construct knowledge. This basic idea can be used by educators to help students construct a meaningful understanding of concepts.

Two levels of development were considered by Vygotsky's (1978) constructivist theory. The first of which is referred to as the actual level of development (Woolfolk, 2010). At this level, the student is able to execute and display knowledge without being assisted by the educator or peers (Tuncel, 2009; Woolfolk, 2010). Vygotsky's (1978) second level of development is identified as the zone of proximal development (ZPD), which is the difference between what the students can do without anyone else's input and what they can do with the support from the more knowledgeable peers or educators through interaction. The student is helped through a process of scaffolding. Although educators could help students acquire knowledge in a number of ways, scaffolding applies only when assistance is applied in the students' ZPD. The educators' part in this point of view is to recognize every student's ZPD and to offer in every lesson the level of motivation expected to progress through the zone and subsequently augment the rate of learning. The help offered in that zone should match the student's prior knowledge (Tuncel, 2009; Woolfolk, 2010) and facilitate the student's development of the newly acquired knowledge and skills. This implies that proper interaction among the student and the educator could facilitate problem-solving abilities and an understanding of concepts. The role of social interaction in knowledge construction is vital in the teaching and learning of mathematics and science as this leads to the importance of incorporating cooperative and collaborative instructional approaches.

The role of the educator is not that of dispensing information but to be an umpire, who works with the student in order to construct knowledge using the activity-based approaches, through cooperation and scaffolding within the ZPD. The educator, therefore, has the responsibility of bringing into the classroom situations, activities and problems that encourages communication, flexibility, imagination, and problem-solving skills (Alessi & Trollip, 2001; Schunk, 2014). It is through these processes that mathematics and science concepts are learned in the classroom. Students are motivated and guided to construct meaning through the use of techniques that include, for instance, exploration and inquiry-based problems, where they generate multiple methods of solving problems in groups (Schunk, 2014).

According to Vygotsky (1978), students become autonomous with skills after they have been directed, taught and guided by the educator. The ZPD emphasizes the need to have educators in the learning process, particularly when introducing new concepts to the students. The educators' role is to help the students to progress to their zone of learning as they are challenged by more knowledgeable personnel so that they enhance their understanding of concepts. Vygotsky's (1978) ZPD of constructivism maintains the essential view that students require social interaction, scaffolding instruction, and a chance to mingle with more knowledgeable students or peers. Crook (1994) identifies two educational implications that are dealt with in the ZPD. Firstly, the ZPD deals with an assessment of the student's level of understanding in a specific area. Secondly, it provides solutions to questions such as, what happens throughout the process of teaching and learning. These two educational issues emanating from the ZPD could inform educators' teaching.

Despite the fact that previous knowledge and realistic resources are crucial in constructivism, the role of the educator in assisting students in solving problems is also crucial. This implies that even though constructivism enables the students to

construct knowledge through their understanding and experiences, learning is as well exceedingly reliant on the educators' capability to scaffold students during the knowledge construction process. According to Alessi and Trollip (2001), this is different from pure discovery environments, because it is a requirement for the educators to guide and become partners in the teaching and learning process. Constructivists maintain that learning activities must be rooted in problems solving situations that are meaningful and appropriate to students (Fetherston, 2006).

The above perspectives share the common view that knowledge must be constructed by the students for it to be meaningful to them, which could be achieved through the active involvement of the students. An elemental principle of constructivism is that learning and thinking take place in a context or an environment, not in vacuity (Schunk, 2014; Tuckman & Monetti, 2011). Meaningful learning of mathematics and science takes place when the students' cultural experiences and their environments are taken into consideration.

The prevailing view is that students do not exist in solitude, but they exist and learn in cultural environments where learning is shared and understanding is created with others (Woolfolk, 2010). Each student's existing information is a potential springboard to move to higher levels of learning (Vygotsky, 1978). Vygotsky's (1978) work acknowledges the importance of social collaboration throughout the academic learning process. According to Vygotsky (1978), knowledge is actively created in social environments and that the development of such knowledge is cultural. The most important idea governing Vygotsky's (1978) constructivist theory is the concept that students acquire knowledge from the individuals who have more understanding and information especially educators through interaction in an environment that is culturally based. From the constructivists' point of view, it is not possible to separate the student from the societal influences because the sociocultural environments in which educating and learning take place are crucial to the learning procedure itself since learning is regarded as socially and contextually specific.

From Vygotsky's (1978) constructivism, language is important in the early stages of learning and this is attained through interaction and cultural heritage. The dialect of the social setting and cultural communications help in the academic development procedure. Dialect is regarded to be essential in the social procedure of meaning-making and social associations are situated in shared and helpful educating and learning conditions that support scaffolding and basic reasoning among the students (Gordon, 2009).

Vygotsky's (1978) idea that knowledge is socially constructed in the social situation has implications for the teaching and learning process. This implies that the teaching and learning of mathematics and science should be contextualized and is influenced by the interaction of students with their environment (Banks, 2008; Kincheloe, 2008). Learning is seen as a related procedure in which the student can effectively make individual meaning of the information acquired through social experiences (NCTM, 2000; Vygotsky, 1978).

In a constructivist classroom, the role of the educator is to guide, facilitate, coach, provoke, and co-explore in manners that enable the students to take part in basic and imaginative reasoning, examination and union of thoughts amid the teaching and learning process (Tuckman & Monetti, 2011). The educator undertakes the role of a co-student who urges students to address, challenge, and outline their views, conclusions, carry out projects, make their comparisons, and make valid conclusions (Sunderman, 2006). In addition, the educator's role is to assume the role of an expert student who guides the students into accepting intellectual strategies, for example, self-testing, articulating understanding, making inquiries, and reflection (Sunderman, 2006).

Furthermore, educators need to assess and make constructive use of the student's prior knowledge and also to organize and structure discussions between students. Constructivism instruction focuses on active learning that results in higher student activity as compared to the presentation of material in the educator-centered classroom (Alessi & Trollip, 2001). Constructivist ideologies deject teaching practices that just transfer information, passively to the students and support the use of resources that encourage the active participation of students through hands-on activities and social interaction (Alessi & Trollip, 2001; Schunk, 2014).

Educators embracing the constructivist principles create a learning environment where students have sufficient chances for the social negotiation of their understandings. Educators are required to plan for tasks and activities that are epitomized by active engagement, authentic learning, situated learning, experience-based, inquiry-based, problem-based learning and research projects, in which students create and test their notions, make deductions and conclusions with others in shared learning environments (Sunderman, 2006).

In addition, constructivists encourage the design of learning environments that are cooperative (Ahsan & Smith, 2016; Alcantara et al., 2009). Cooperative learning enables the students to work together, sharing different ways of thinking, and perfect the way in which one clarifies ideas. Cooperative learning increases student involvement and socialization skills. Cooperative learning is a social procedure that comprises group establishment, sense-making and the making of decisions (Ahsan & Smith, 2016; Alcantara et al., 2009) where all teaching and learning activities are collaborative.

Even though constructivists encourage the construction of knowledge in collaborative settings, this can only become meaningful if the cooperative learning activities allow students to incorporate their developed ideas, notions, and principles into the real-life situation (Alcantara et al., 2009). When working in groups to solve problems, students are symbiotic and are motivated to solve the problems. The abler students have the chance to support others and, if duties are assigned, all the students participate actively. By making use of constructivism, educators might scaffold instruction and learning to encourage group processes that augment and enhance students' cognitive development. Through working and communicating together in groups quite a number of meaningful connections could be made so that students would be able to make useful connections and constructions during their process of learning.

Furthermore, in designing learning environments that fit into the constructivist views, educators are anticipated to prepare lessons by choosing suitable teaching materials and approaches, in addition to, practical assessments that would encourage students' construction of knowledge. With the intention of improving learning environments, scholars suggested the use of a diversity of teaching approaches that would result in effective teaching and learning (Golashani, 2013).

The construction of new knowledge entails active and basic reasoning abilities on the part of the student as new information is merged with prior knowledge. The deepness and number of links made impacts on the extent of acquiring new learning. Acknowledging the role played by prior experiences in learning new concepts might lead educators who embrace constructivist views of teaching not to simply question whether a student understands a concept, but how he/she understands it and what ideas to which the student is connecting it (Van de Walle, 2007). The purpose of the constructivist classroom is to encourage interactions of students' previous and new knowledge and understanding that would lead to new knowledge being applied to both school activities and out-of-school activities as well. The transmission of knowledge is an important component of constructivism. The acquisition and use of knowledge are not isolated from social activities and are often elicited as a result of being involved in a particular situation.

The constructivists focus on using students' interests and prior experiences as a springboard for acquiring new knowledge, as well as encouraging discussion about understandings, questions, and experiences (Alessi & Trollip, 2001). Constructivist ideas in teaching result in effective teaching that rely on how familiar the mathematics and science concepts are to the students and how these concepts are taught shapes the manner in which the material is understood (Schunk, 2014).

METHODOLOGY

This section focuses on the research design, sample, instruments, and data analysis procedures.

Research Design

To investigate student teachers' classroom experiences in connection to constructivist principles descriptive research that included questionnaires and observation was used. The objective of this descriptive research is to describe the student teachers' experiences on the way they were taught a pedagogy course in relation to constructivism principles.

Participants

39 diploma in science education pre-service educators (20 female and 19 male) who were in their second year first semester of study took part in this study. The diploma is a three-year six-semester program specializing in science and mathematics. The student teachers are offered science courses, mathematics courses as well as professional courses. Professional courses include educational foundations courses, health courses, communications skills course, computer skills course, research methods and project, a pedagogy course, a pre-practicum course, and a practicum course. The pedagogy and pre-practicum courses are prerequisites for the practicum hence are taught concurrently. Student teachers also go out for their practicum in schools for one year and then come back for half a year to study again science courses, mathematics courses and professional courses. Convenience sampling was used to select the participants of this study focusing only on the pedagogy course which comprises teaching approaches such as constructivist approaches, student-centered approaches, and the traditional/educator centered approaches. Student teachers' participation was voluntary and their names were not used in this study.

Instruments

In descriptive research questionnaires and observation are usually used as data collection instruments (Gall et al., 2007). In this descriptive research study, questionnaires and observation were used in order to obtain information from the student teachers' experiences on the way they were taught a pedagogy course in relation to constructivism principles. The questionnaire comprised of 22 Likert-type items and three open-ended questions. Questionnaires were used for the reason that they are economical and are used in a manner that the participants remain anonymous (McMillan & Schumacher, 2010). The questionnaire comprised of Likert-type questions that resulted in quantitative data and open-ended questions that resulted in qualitative data. According to McMillan and Schumacher (2010), this approach is known as a "multi-method strategy" that enables data triangulation as a way of enhancing the validity of the findings. Piloting of the questionnaires was carried out with 10 student teachers thereafter the pilot results were used to revise the questionnaire items.

The non-participant observation was also used in gathering data about the student teachers and their educators' actual practice in the pedagogy lecture. An observation guide was used once a month for two hours for the 12 weeks. Three educators at the university under study responsible for the validation of instruments validated both the observation guide items and the questionnaire items.

Data Collection and Analysis Procedures

The pedagogy course in which the student teachers were enrolled met twice a week for two hours for 12 weeks. The instructor of the course was a colleague at the university under study. The questionnaires were self-administered to 39 students who all volunteered to take part in the study during the last week of the course. The Likert-type questions were analyzed using descriptive statistics. A thematic analysis approach was used for the observation data as the study was concerned with what was said and what they did during the lecture and not how it was said or how it was done (Davies, 2007).

Table 1. Student teachers' level of interaction (n=39)

Statement	SA/A	NR	D/SD
	%	%	%
1. Educators require students to work quietly in lecture rooms.	12	0	88
2. Educators allow students to assist each other.	85	6	9
3. Educators allow students to explain their views to each other.	97	3	0
4. Educators allow students to ask each other questions in the lecture.	75	16	9
17. Educators encourage students to learn independently.	53	22	25
20. Educator was in a continuous and interactive dialogue with the students.	60	34	6
21. Learning was interactive for the pedagogy course.	47	19	34

Table 2. Student teachers in the planning of learning and assessment activities (n=39)

Statement	SA/A	NR	D/SD
	%	%	%
1. Educators involve students in deciding the content to be learned .	3	0	97
11. Educators always plan the assessment program with students.	38	21	41
12. Educators consult students for their views on learning activities.	44	12	44
13. Educator lectures from the front .	56	0	44
19. Students engaged in collaborative activities with other students and educator.	72	16	12

RESULTS AND DISCUSSION

This section presents the findings according to the data gathering methods used in this study. The results from the questionnaires are presented first followed by those from observation.

Responses from Questionnaires

For analysis purposes, the 22 questions were classified into four categories. These are student teachers' levels of interaction, involving student teachers in the planning of learning and assessment activities, connecting and applying mathematics and science to a real-life situation, and accommodating student teachers' views.

Student teachers' level of interaction

Interaction amongst the students is one of the major characteristics of constructivist learning environments. **Table 1** shows the extent to which student teachers interact.

From **Table 1**, 88% of the student teachers did not agree with the statement that their educators require them to work quietly in lecture rooms. 97% indicated that they are allowed to explain their views to other students and students are also allowed to assist each other during lectures. Student teachers are encouraged to engage in dialogue both with the educator and with fellow students. This results in student teachers changing or reinforcing their thinking and ideas through collective dialogue. When student teachers are presented with such chances to share their ideas and listen to as well as reflecting on the ideas of fellow students they are empowered. This allows the student teachers to construct new knowledge or reflect on their prevailing understandings. Interactive dialogue is the basis upon which collaborative learning is established.

Involvement of student teachers in the planning of learning and assessment activities

Students' active participation in the planning of learning and assessment activities is a crucial aspect of constructivist approaches. Students are required to decide what they should be taught together with the educators. **Table 2** shows students' involvement in planning and assessment activities.

Although 72% of the students were of the view that they were involved in collaborative activities with other students and the lecture, the student teachers (97%) were of the view that they were not involved in deciding the content to be learned. The finding showed that student teachers (38%) only agreed that they were involved in assessment programs. Some student teachers (56%) indicated that educator lectures from the front which is contradictory to the constructivist approaches where the educator's role is to guide and facilitate the teaching and learning process as suggested by Tuckman and Monetti (2011).

Connecting and applying mathematics to the real-life situation

Constructivist approaches put more emphasize on presenting students with learning situations that are related to cultural background and environment as well as the application of acquired knowledge into real-life situations. The role of educators is to facilitate the learning process by choosing appropriate and meaningful learning activities for students to work on. **Table 3** shows the extent to which student teachers were exposed contextualized activities.

From **Table 3**, 75% of the student teachers indicated that their educator always connects the teaching and learning activities to everyday life and includes learning experiences that include problems that are important to them. The findings concur with Ahsan and Smith (2016) and Loyens et al. (2009) who were of the view that real-life examples should be part and parcel of the teaching and learning process.

Table 3. Student teachers' exposure to contextualized activities (n=39)

Statement	SA/A	NR	D/SD
	%	%	%
5. Educators always connect the teaching and learning activities to the everyday life.	75	22	3
18. Educators ensure that learning experiences include problems that are important to the students.	75	19	6
22. Educators encourage students to put acquired knowledge into practice.	53	41	6

Table 4. Educators' accommodation of student teachers' views (n=39)

Statement	SA/A	NR	D/SD
	%	%	%
6. Educators insist that students use the formulae that they gave them to arrive at the correct answers.	47	40	13
7. Educators allow students to use their methods in solving problems.	63	22	15
8. Educators don't allow their lectures to be disrupted by students.	47	34	19
9. Educators always allow students to question their views.	47	0	53
14. Educators consider their students' prior knowledge.	81	13	6
15. Students are allowed to construct new understandings using their prior knowledge.	84	3	13
16. Educators promote students' critical thinking.	78	0	22
23. Educators encourage students to put acquired knowledge into practice.	53	41	6

Table 5. Educator' roles in pedagogy course (n=39)

Educator's roles aligned to constructivist perspectives (frequency)	Educator's roles aligned to traditional centered approaches (frequency)
To guide students & help them achieve their goals especially make them being practical experts.	The educator chooses content to be learned & arranges it in his/her module (7)
To facilitate the learning process (11)	To interpret the module
To develop critical thinking skills (6)	To teach (2)
To develop teamwork in students	To develop course outline & modules (3)
To conduct learning activities (2)	To direct and conduct the learning (2)
To supervise project (4)	To develop notes for students
To give students a guideline on the learning activities (3)	To lecture to students & impart knowledge, values, & skills to students (10)
To motivate students to learn (4)	

Accommodation of student teachers' views

In constructivist approaches, students' views are important as they work in groups sharing ideas and reflecting on the problem at hand. The educators as facilitators should allow their students to share the thinking that might vary from theirs. **Table 4** displays the extent to which student teachers were allowed to share their ideas.

From **Table 4**, student teachers (84%) indicated that they are allowed to construct new understanding using prior knowledge. Student teachers (81%) indicated that educators consider their prior knowledge during teaching. The use of students' prior knowledge concurs with Vygosky's (1978) principles of constructivism. Student teachers (78%) showed that educators promote students' critical thinking. This finding concurs with Boaler (2009) who pointed out that constructivist approaches encourage critical thinking. Only 47% of the student teachers were of the view that they were allowed to question educators' views. When lectures share their views without being questioned by the student teachers, their examination of their views is eliminated. Such situations will make students stop thinking about the concept and wait for the educator to be the source of knowledge and all ideas. As a result, students are not in a position to construct their knowledge. Furthermore, the findings showed that 63% of the student teachers were of the view that students were allowed to use their method in solving a problem which concurs with Schunk (2014) who reported that in constructivist approaches students make use of multiple methods in solving problems.

Responses from Open-Ended Questionnaire Questions

Educator's role in the pedagogy course

The student teachers described their educator's roles and their roles in the open-ended questionnaire questions that were categorized into two; aligned to the constructivist view and aligned to the traditional/educator-centered approaches as indicated in **Table 5**.

The duties of the educator are to develop the course outline and the modules to be used when teaching is one of the major characteristics of the traditional approaches to teaching. The view that educators impart knowledge is also aligned to the traditional perspectives. On the other hand, educator's role aligned to the constructivist approaches were to facilitate learning and to develop teamwork in students. In addition, students' collaboration in pairs or groups enables them to share their process of constructing knowledge. The shared effort provides the students with an opportunity of reflecting on as well as elaborating on their ideas as well as those of their peers too. In collaborative learning situations, students view their fellow students as resources instead of as opponents. Furthermore, some of the student teachers pointed out that the role of the educator is to motivate the learners to learn which concurs with Schunk (2014) who was of the idea that in constructivist approaches students are motivated to learn.

Table 6. Student teachers' roles in pedagogy course (n=39)

Student teachers' roles aligned to constructivist perspectives (frequency)	Student teachers' roles aligned to the traditional centered approaches (frequency)
To be creative	To acquire knowledge and concepts from an educator (15)
To gather and use the information he /she has in real life	To learn (6)
To discover new knowledge and apply it	
To develop knowledge and skills through guided discovery	
To acquire knowledge and skills on hands-on projects	
To display acquired knowledge into practices then projects	
To develop critical thinking skills (4)	
To develop problem-solving skills after acquiring knowledge	
To develop hands-on skills and abilities	
To develop skills necessary for helping the society	

Table 7. Student teachers and educators' observed teaching and learning practices

Session	Teaching approach	Student interaction	Link content to students' prior knowledge and environment	Accommodating students' views	Application of learned concept
1	Lecture method & demonstration	Individual work is assigned in form of an assignment at the end of the lecture	Lecturer gave students chance to use their already acquired knowledge to explain & answer questions.	Students asked questions & were allowed to say their thinking & express their views.	None
2	Lecture method & demonstration	Pair work on tasks given by the educator. Asking a fellow student to explain another student's thinking.	Course-related to how students were taught to answer practical questions without doing actual practice in science, e.g., when testing for starch students was meant to recall how starch tends blue-black when iodine was used.	Presenting solutions after pair work so that fellow students & educator are exposed to other methods of solving same problem. Students were asked to explain their methods & how they arrived answer.	Students demonstrated the ability to teach fellow students.
3	Presentation by students on science & mathematics-related pedagogy questions	Ask questions & contribute to presentations.	Examples are drawn from various real-life situations	Educator even appreciated how students delivered lectures & how they answered question asked by fellow students.	During presentation, students applied learned concepts in delivering content.
4	Peer teaching	Group work tasks are assigned to fellow students. Discussions on both contents delivered & how it was delivered done by both educator & students	Examples are drawn from various real-life situations.		During peer teaching, pedagogy concepts were displayed in various ways e.g. lesson introduction & conclusions by students as well as handling other students in terms of managing the lecture.

Student teachers' role in the pedagogy course

Table 6 shows student teachers' roles in a pedagogy course.

The students' roles aligned to the traditional approaches were to learn and acquiring knowledge concepts from the expert. These roles contradict the constructivist approaches where students should be guided to develop, acquire and apply the learned concepts in real life as suggested by Mvududu and Thiel-Burgess (2012). On the other hand, the roles of the students from a constructivist perspective were shifted from acquiring knowledge to the acquisition and application of knowledge in solving real-life problems and developing skills required for helping society. Learning is not measured on the amount of knowledge reproduced but on how students demonstrate their knowledge and skills in real-life situations. To be able to function in such a manner, students need a different set of responsibilities in the classroom setup. For instance, from Table 6, student teachers view their roles as that of becoming critical thinkers and problem solvers in life that are some of the principles of constructivist approaches. In addition, developing hands-on skills and abilities was also mentioned as one of the roles by some of the student teachers. The findings are in line with Alessi and Trollip (2001) and Schunk (2014) who were of the view that constructivism approaches encourage active participation of students through hands-on activities and social interaction.

Results from Observation

Table 7 shows student teachers and educators' teaching and learning practices. The idea that students demonstrated what they learned or their answers to the rest of the students are in line with the constructivist approaches. The use of small-group learning, pair work, and collaborative learning is highly appreciated in constructivist approaches where ownership of learning is shifted from the educator to the students. The findings are in line with Ahsan and Smith (2016) and Alcantara et al. (2009) who were of the view that collaborative learning is one of the principles of constructivism.

Without the student involvement in the designing of the course content and the pedagogy requirements, it could be a sheer waste of time to claim that the students were fully exposed to the constructivist approaches. The use of innovative pedagogy without student engagement in curriculum/course design would not benefit the students as expected. Students are likely to benefit more from examples that are drawn or related to their day-to-day activities.

Peer teaching was also part of the lessons that were observed which was useful in scaffolding the learning of fellow students. In this case, the educator and the peer tutors act as guides to the fellow students who are less expert in the areas that required peer tutoring which is in line with Vygotsky's (1978) ZDP in which more knowledgeable students assist their fellow students. The peer tutors help the fellow students by making some tasks simpler. The fellow students that were being assisted were not considered to be passive as they were actively involved in all the activities. It was also observed that peer teaching and tutoring arrangements were as well organized by students themselves by way of looking for help from peers and the educator indicating that the philosophy of teamwork has been established. The students were responsible for all the activities that they were performing. The students also complemented each other for the good work. For instance, one of the students commented "That was a very good example, nice one". Such a comment indicates that the students view themselves as real knowledge contributors in the teaching and learning process. Learning focused on students' views as well as other activities.

CONCLUSION

The findings showed that despite being involved in cooperative activities and peer teaching the student teachers are not involved in deciding the content that they should be taught. The results of this study have implications for the student teachers, future teaching practices. Feixas and Euler (2013) were of the view that teachers' experiences influence them in implementing diverse teaching approaches and developing numerous views about teaching and learning. Therefore, the teaching and learning approaches that the teachers were exposed to during training should closely bear a resemblance to the teaching and learning approaches that the teachers would be expected to implement in schools. For instance, the approaches that these student teachers would use in the future in teaching would be determined by what they know and how they were trained. In order to deepen student teachers' learning, the effort was made for student teachers to put into practice concepts as well as pedagogies learned as they were involved in peer teaching in preparation for the teaching practice. It is anticipated that if student teachers were exposed to constructivist approaches they are likely to adopt these approaches as teachers. Through their experience with constructivist approaches as student teachers, they are likely to have a better understanding of what constructivist approaches consist of and possibly implement its principles in schools. The study recommends that student teachers should be given a chance to decide on what they should be taught in the pedagogy course.

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