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PRE-SERVICE TEACHERS' PERCEPTIONS OF COLLEGE TUTORS' USE OF STUDENT-CENTRED APPROACH OF TEACHING AND LEARNING MATHEMATICS

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ABSTRACT: *The study sought to explore pre-service teachers' perceptions of tutors' use of student-centred approach of teaching and learning Mathematics in Akatsi College of Education. The study also evaluated pre-service teachers' learning experiences in relation to their active and passive learning.The study used descriptive survey design. A structured questionnaire was used to collect data from one hundred and ninety-seven pre-service teachers who were purposively sampled for the study. The data collected was analysed using means and standard deviations. The results of the study revealed that College tutors used both student-centred and teacher-centred approaches of teaching Mathematics. In addition, students' learning experiences could be described as a mixed bag, incorporating both active and passive learning experiences, with most of the pre-services involved in active learning. Consequently, it was recommended that during the development and implementation of the subject course manuals, tutors should be encouraged to use student-centred approach of teaching and learning Mathematics in the Colleges of Education. Also, since stakeholders of Initial Teacher Education programme, made provision for 60% of continuous assessment marks in the implementation National Teacher Education Assessment Policy, tutors no matter the circumstances, should engage pre-service teachers in student-centred Mathematics lessons.*

KEYWORDS: pre-service teachers, student-centred teaching and learning, mathematics, active learning.

INTRODUCTION

The teaching and learning of mathematics until the early 1970s have been underpinned by the principles of behaviourism, and this is still applicable in most mathematics classrooms around the world. The principle of behaviourism, where the teacher is considered as the custodian of knowledge and expected to transmit that knowledge, has been highly criticised by a number of researchers after it has dominated the teaching and learning practices in many classrooms over the years. According to Boaler (2009), this approach of teaching and learning has been unable to produce students who are critical thinkers. In addition, students do not understand the utilitarian nature of the Mathematical skills and concepts that they have learned. As a result, the search for new theories to help increase students' participation in the teaching-learning process became necessary; hence, the evolution of the constructivist theory of learning in the 1970s.

Research findings suggest that the Ghanaian mathematics classroom like most other classrooms in Africa is characterised by prescriptive instructional behaviours and passive learning styles among many students (Akyeampong, Pryor & Ampiah, 2006). The Ghanaian mathematics curriculum like that of most other countries around the world has undergone major restructuring since the late 1980s.

This restructuring of the mathematics curriculum has been necessitated by numerous research findings (Akyeampong, Pryor and Ampiah 2006; Ampadu 2013).

However, Adu-Yeboah, Kwaah, Abreh, and Amuah (2014) observed that despite the structural changes in teacher education programmes in Ghana, learner- centred pedagogy is not embedded in pre-service teachers' classroom practice. Akyeampong (2017) also observed that Ghanaian teachers continue to practice teacher-centred instruction with the emphasis on teaching and learning materials and small groups activity.

Meanwhile, the need for a student-centred approach to the teaching and learning of Mathematics saw the latest teacher education reform, Transforming Teacher Education and Learning (T-TEL) which started in 2015 and funded by the UK's Department for International Development (DFID) to transform the delivery of pre-service teacher education in Ghana by improving the quality of teaching and learning of Mathematics. T-TEL saw a theoretical shift in mathematics education from a teacher-centred approach to teaching to a more student-centred approach in teacher training institutions (Ministry of Education, 2017). Also, the need for a student-centred approach to the teaching and learning of mathematics has constructivist approach re-echoed explicitly in the teaching and learning philosophies of the new mathematics curriculum which was introduced in 2019 (National Council for Curriculum and Assessment (NaCCA), 2019).

Collins and O'Brien (2003) defined student-centered learning as an instructional approach in which students influence the content, activities, materials, and pace of learning. Ganyaupfu (2013) also explained that, learner-centred teaching approaches produce better and high learning outcome and provide efficient skills as compared to other approaches. Baeten (2010) observed that student-centered learning fosters deep learning and understanding. In contrast teacher-centered approach as more formal approach of teaching which focus on moving the entire class through the curriculum by teacher led activities (Chall,2000).

In order to understand and explore ways of improving students' learning and understanding of Mathematics, researchers have advocated for the need for a holistic view of changing the teaching-learning processes in schools. One way that these ideas have been conceptualised in the mathematics classrooms is the shift from the teacher-centred approach of teaching with its accompanying rote learning, to the student-centred approach which helps students to generate their own meaning and understanding of mathematical concepts (Anku, 2008; Boaler, 2006).

Wright (2011) observed that college and university level institutions are extremely instructor-centred and that this situation works against students becoming successful mature learners. Froyd and Simpson (2010) emphasized that student-centered learning puts forth students' prior knowledge as it influences future learning. Students in this mode of learning are seen to be more extrinsically motivated and learn important skills such as critical thinking and problem solving (Froyd & Simpson, 2010).

Moreover, student centred learning is a learning approach where students are the focus of the learning process; preparing the lesson prior to the intended lecture, participating actively in class and working to achieve a common academic goal (Zain, Rasidi, Abidin, 2012). Moreover, Zain, Rasidi, and Abidin (2012) explored the effects of the student-centred learning (SCL) approach in Mathematics on learning skills among pre-university students and teachers; and their perceptions of the student-centered learning technique in the course. The study used both a quantitative and qualitative approach.

The data was analysed and discussed against the Constructivist theory as the theoretical framework. The study revealed that there was a gap between what students expected in their learning and what teachers taught them.

Chall (2000) reviewed researches on student-centred and traditional teacher-centred approaches and found that combining a teacher-centred approach with student group work was more effective than using strictly student-centered approach. It was found that students learning in groups while teacher led instruction is incorporated led to higher achievement than individualized student centered learning. Similarly, O'Neill (2005) observed that focusing completely on the individual learner in a student-centered classroom is dangerous since the learner needs the class as a whole.

According to Darling-Hammond and Bransford (2005), teacher education programmes should reflect what is known about learning and teaching since the most important aim of education is to promote student learning, theories and ideas about learning and their application to teaching practice should be an essential part of any teacher education programme. Conner and Sliwka (2014) explained that evolving concept of learning has moved from reinforcement of positive learning behaviours and information processing to more active ways by which learners can make sense of new knowledge using socially mediated or negotiated ways of learning.

According to Holt-Reynolds (1991), it is undesirable for learning when students are passive while teaching is taking place. Unlike passive learning, through active learning process students, partially developed their analytical awareness and justify every concept (Bulut, 2018; Wagganer, 2015), performance is increased and interaction abilities are improved (Edwards, 2015).

According to Ahmed and Aziz (2009), teachers' perception of their teaching is of great importance in measuring the effectiveness of Mathematics teaching and learning and it also reinforces teacher's decision making. Furthermore, Ahmed and Aziz (2009) observed that collecting data from students regarding their teachers' teaching provides meaningful data of what their teachers do. Ahmed and Aziz further explained that collecting data from students about their teachers' teaching is valuable as their perceptions are "coloured by challenging and interesting experiences that allow them to observe learning and teaching behaviours more intimately than their teachers" (p.19). That is, students' perception of their teachers teaching contribute very much in improving the teaching and learning of the subject as it provides valuable suggestions and directions for the teacher's future improvement (Ahmed and Aziz 2009).

Ampadu (2012) studied students' perception of their teachers teaching and perception of their learning experiences. Three hundred and fifty-eight (358) students who were randomly selected completed semi-structured questionnaire. The results of the study revealed that most of the respondents perceive their teacher as the custodian of knowledge. The results showed that, in general, students agreed that their teachers were most likely to use both student-centred and teacher-centred approaches. For example, majority of the students' report that the teacher tried to explain things carefully to prevent them from making mistakes. In addition, the majority of students indicated that the teacher told them which method to use and this is consistent with teachers' perceptions of their own teaching practices. Students also reported that teachers used both teacher-centred and student-centred approaches for teaching; however, the use of teacher-centred approaches was proportionately higher as compared to student-centred approaches. Students ascribed higher percentages to teacher-led activities than student-led activities.

Ampadu and Danso (2018) study Constructivism in Ghanaian Mathematics classroom and found that the importance of students' participation and teamwork have not been fully conceptualized into Ghanaian classrooms due to cultural factors. Firstly, the culture of acknowledging only correct answers in class has a negative impact on individual students' confidence and participation during Mathematics lessons. In addition, the culture of teamwork is not fully accepted within Ghanaian classrooms as most students find it difficult working in groups and accepting and appreciating each other's view. When data was collected from 250 students was analysed, the results revealed that the epistemological beliefs suggested that the principles of constructivism has not been fully conceptualized into Ghanaian mathematics classrooms due to some cultural factors. For example, the majority (83%) of teachers indicated that they encouraged there to use the methods they taught them. Also teachers explained things carefully to their students to help them avoid mistakes. Besides, the dominance of the teacher in the teaching and learning was evident. For example, the majority of the students indicated that they listened while the teacher explained, and 80% also reported that they solved questions that they were asked to solve.

Problem Statement

Akyeampong (2017) observed that in the Ghanaian context, teacher educators continue to practice teacher-centered instruction while emphasizing the use of teaching and learning materials (TLMs) and small group activities as representing innovative methods to change the traditional teaching characterized by rote-learning, chorus responses, and copying and imitation. Furthermore, teacher educators do not see the importance of understanding the classroom contexts based on the premise that teacher-centered approach can be practiced regardless of the classroom contexts. Since 2004, Ghanaian teacher education reforms have contributed to this situation by emphasizing activities that could be used in learner-centered pedagogy, but not the principle - that knowledge should be co-constructed between the teacher educator and pre-service teachers, instead of transmitted from teacher educators to pre-service teachers.

Moreover, during the longitudinal study conducted by T-TEL, revealed that 54.5% of tutors in Akatsi College of Education did not agree they use lecture method in class. However, 50% of the students teachers agreed that their tutors used lecture method in class. Meanwhile tutors demonstrated that they were creative, committed and motivated to use student-centred methods, however, are often in the minority (Ministry of Education, 2018). The problem in this study, therefore, was to assess how pre-service teachers perceive their tutors' use of learner-centred approach of teaching and learning Mathematics as well as their views on learning Mathematics passively and actively.

Purpose of the Study

Mereku (2001) observed that Ghana most of the mathematics teachers at the basic schools taught largely through lecturing and teacher-centered approaches. According to Mereku (2001), these methods deny pupils from experiencing the learning of mathematics using manipulative materials and this inhibited the development of the pupils' intuition, imagination and creative abilities thus leading to poor understanding of mathematics concepts. Eshun (2000) argued that it was important that mathematics as a subject in Ghana should also be transformed in its teaching and learning to meet the challenges demanded of it by the ever-changing world.

Meanwhile, the Government of Ghana has undertaken transformation of teacher education and learning coupled with the introduction of specialism programmes in order to improve the quality of teacher delivery. As part of the transformation, College tutors during their professional development sessions discussed various teaching strategies with the emphasis on student-centred approaches of

teaching Mathematics. For some time now since the implementation of the teacher transformation programmes, few studies have been conducted to assess how college tutors implement student-centred approaches of teaching and learning mathematics. The purpose of this study was therefore, to assess the extent which college tutors use student-centred approach in teaching mathematics as well as evaluate students' active and passive mathematics learning experiences.

Research Questions

1. To what extent do pre-service teachers perceive their college tutors' teaching methods in relation to teacher-centred and student-centred teaching methods?

2. What are students' views of their own learning of Mathematics in relation to passive and active learning experiences?

Significance of the Study

This study is significant because the results will determine the extent which pre-service teachers are prepared to implement learner-centred method of teaching captured as the teaching and learning philosophies in the new standard-based curriculum in Ghana.

METHODOLOGY

Research Design

A cross-sectional survey design was used to collect data to address the research question. VanderStoep and Johnson (2008) asserted that a survey is the best way to collect a large amount of data from a population in a short time. It is a research design in which the researcher administered questionnaires or interviews to sample or the entire population of people and statistically analyse the data to describe the attitudes, opinions, behaviours or characteristics of the population (Creswell, 2014).

Population and Sample

The target population for the study comprised three hundred and twenty (320) level 100 undergraduate pre-service teachers pursuing Bachelor of Education in Akatsi College of Education. The level 100 pre-service teachers were targeted because they were taught using student-centred approach. The level 100 pre-service teachers possessed the unique characteristics needed to serve as respondents for the study in order to address. The sample for the study comprised 197 level 100 undergraduate pre-service teachers who were randomly selected.

Instrument

The questionnaire used for data collection was adopted from the similar study conducted by Ampadu (2018) which evaluated students' perceptions of their teachers' lesson delivery. The questionnaire was divided into two parts. The first part of the questions has 10 questions which assessed pre-service teachers' perception of their tutors use of student-centred and teacher-centred approach of teaching mathematics. The second part has 10 questions which sought to evaluate pre-service views regarding how they learnt Mathematics in their classrooms based on 4-Likert scale format. The questionnaire made use of a 4-Likert-type response format (1=strongly disagree, 2=agree, 3=disagree and 4= strongly agree). The scores are interpreted as follows: On the scale of 1 to 4, 2.5 being the median. When the mean is above 2.5 it implies the perception exists, but when the mean is below 2.5, it implies the perception does not exist.

RESULTS

Research Question 1: To what extent do pre-service teachers perceive their college tutors' teaching methods in relation to teacher-centred and student-centred teaching methods?

Table 4.1: Pre-service Teachers Perceptions of their Tutors' Teaching (N=197)

Student-Led Climate	**M**	**SD**
Learn through discussion of ideas	3.08	0.905
Compare methods for solving problems	3.21	0.848
Make and discuss mistakes	2.58	1.040
Work in pairs or groups	3.24	0.882
Invent and use own methods	2.42	0.914
Grand mean	2.91	0.918
Teacher-Led Climate	**M**	**SD**
Teacher prevents us from making mistakes	3.07	0.969
Teacher ask us to work through practice exercise	3.29	0.785
Teacher shows us the method to use	3.06	0.890
Teacher tells which question to solve	2.19	0.865
Teacher expects us to follow textbook closely	2.19	0.859
Grand mean	2.76	0.874

Table 4.1 reveals that pre-service teachers perceived that their college tutors used student-centred approach in teaching Mathematics with a mean value around 3 (on a 1-4 scale). The results in Table 4.1 revealed that pre-service teachers worked in pairs or groups during mathematics lessons (mean = 3.24, SD= 0.882). Pre-service teachers also compared different methods they used for solving Mathematics problems (mean = 3.21, SD = 0.848) and learn through discussion of their ideas (mean = 3.08, SD = 0.905).

Similarly, Table 4.1 shows that tutors asked pre-service teachers to work through practice exercises (mean = 3.29, SD = 0.785). Tutors also prevented pre-service teachers from making mistakes (mean= 3.07, SD = 0.969) and also showed pre-service teachers the methods to use in solving Mathematics problems (mean = 3.06, SD = 0.890). The results showed that, in general, pre-service teachers agreed that college tutors used both student-centred and teacher-centred approaches. Moreover, the results in Table 4.1 shows that mean of college tutors who used student-centred approach (mean = 2.91) is higher than the mean (mean = 2.76) of those who used teacher-centred approach in teaching mathematics.

Research Question 2: What are students' views of their own learning of Mathematics in relation to passive and active learning experiences?

Table 4.2: Pre-service Teachers Views of their Learning experiences (N = 197)

Active learning Strategy	**M**	**SD**
Discuss my ideas in pairs or groups	3.26	0.828
Compare different methods used to solve problems	3.44	0.498
Ask questions for understanding	3.44	0.687
Use different ways to solve problems	3.41	0.637
Make my own questions and methods	2.73	1.618
Grand mean	3.26	0.854
Passive learning Strategy	**M**	**SD**
Listen while teacher explains	3.47	0.510
Copy down methods from the board or textbooks	3.47	0.511
Solve easy problems first to increase confidence	3.50	0.521
I solve questions if am told	2.16	1.092
Work on my own	3.25	0.856
Grand mean	3.17	0.698

From Table 4.2, pre-service teachers learn mathematics differently. Majority of pre-service teachers reported that they compared their methods they used to solve problems (mean = 3.44, SD= 0.498). Pre-service teachers also asked questions for clarification to improve their understanding of mathematics concepts (mean = 3.44. SD= 0.687). Even though, College tutors showed pre-service teachers the methods to use in solving Mathematics problems, pre-service teachers also used different ways and methods to solve Mathematics problems (mean = 3.41, SD = 0.637).

A significant number of pre-service teachers were also engaged in passive learning (mean =3.17, SD = 0.698). Pre-service teachers indicated that they solved easy problems in order to gain confidence (mean =3.50, SD = 0.521). Pre-service teachers indicated that they listened while their tutors explained mathematics concepts (mean= 3.47, SD = 0.510) and then copied down the methods college tutors used to solve problems from the board into their books (mean = 3.47, SD = 0.511). In summary, students' mathematics learning experiences from Table 4.2 could be described as mixed bag, indicating that pre-service teachers incorporated both active and passive learning experience, although they engaged more in active learning strategies. Table 4.2 revealed that the mean of pre-service teachers who engaged in active learning have their mean (mean= 3.26) higher than those who engaged themselves in passive learning (mean= 3.17).

DISCUSSIONS

The main purpose of the study was to assess students' perceptions of their college tutors' teaching as well as students' views of their Mathematics learning experiences of the new initial teacher education programme. The research is significant for the unprecedented calls for the use of student-centred approach of teaching and learning Mathematics (T-TEL,2016).

The study revealed that most of the pre-service teachers perceived that their college tutors used student-centred method to engage them in teaching and learning processes to construct their own knowledge using their previous experiences. For example, the college tutors engaged pre-service teachers in groups as well as in pairs to discuss their ideas during mathematics lessons. Pre-service teachers after solving mathematics problems compared methods they used. The college tutors asked pre-service teachers to work through practice exercise, prevented them from making mistakes and showed them the methods they could use to solve mathematics problems.

The college tutors use of student-centred and teacher-centred approach of teaching and learning Mathematics is consistent with the study conducted by Ampadu (2018) which reported that students learned through discussion of their ideas, study in groups and compared their methods they used to solve problems. Pre-service teachers indicated teachers told students the method to be used to solve problems. In addition, pre-service teachers explained things carefully to prevent them from making mistakes.

Besides, the findings are consistent with the study of Ampadu and Danso (2018) which reported that majority of teachers indicated that they encouraged their students to use the methods they taught them as well as explained things carefully to their students to help them avoid mistakes.

The findings of this study revealed that college tutors ensured that pre-service teachers work through practice exercises. College tutors dominated Mathematics lessons to the extent of showing pre-service teachers step-by- step what to do and prevented pre-service teachers from making mistakes. This finding is consistent with the results of Ampadu and Danso (2020) which reported that the majority, (83%) of pre-service teachers indicated that they were encouraged to use the methods they taught them. In a nut shell, it could be argued that students' views of their teachers' teaching is a 'mixed bag' where college tutors employed both teacher-centred and student-centred approaches in their Mathematics lesson delivery.

With regard to pre-service teachers active learning experiences, the results of the study showed that pre-service teachers compared their different methods they used to solve Mathematics problems, asked questions for understanding, used different ways to solve problems and discussed ideas in pairs and groups. The findings are in line with the study of Ampadu (2012) which reported that students discussed their ideas in pairs or groups, employed different methods in solving problems and asked questions for clarification when they did not understand a Mathematics concept.

Concerning pre-service teachers passive learning experiences, they solved easy problems first for their confidence, listened while teachers explained concepts during lesson and then copied down methods college tutors used in solving Mathematics problem. Thus, pre-service teachers solved easy problems to boost their confidence. The findings are consistent with that Ampadu's (2012) study which found that students listened to their teachers while they explained concepts and then copied the methods teachers used to solve problems from the board. In addition, students solved easy problems first to increase their confidence. The findings are in line with that of Ampadu and Danso (2018) which reported that majority of the students indicated that they listened while the teacher explained concepts. Also, students solved questions that they were asked to solve.

CONCLUSIONS

The evidence available from the findings of the study provided the basis for the following conclusions:

- College tutors used both student-centred and teacher-centred approaches of teaching Mathematics.
- Students' learning experiences could be described as a mixed bag, incorporating both active and passive learning experiences, with most of the pre-services involved in active learning.

Recommendations

Based on the findings and conclusions, the following recommendation were made:

- Mentoring universities which Colleges of Education are affiliated to should make frantic effort to ensure that they incorporate student-centred approach of teaching and learning in the professional development manuals for discussion during professional development sessions to enable college tutors use the approach in teaching and learning Mathematics.
- During the development and implementation of the subject course manuals for Mathematics, tutors should be encouraged tutors to use student-centred approach of teaching and learning Mathematics in the Colleges of Education.
- In order to promote student-centred teaching and learning, stakeholders of Initial Teacher Education programme, made provision for 60% of continuous assessment marks in the implementation National Teacher Education Assessment Policy. Therefore, tutors no matter the circumstances, engage pre-service teachers in student-centred approach of teaching and learning Mathematics lessons.

Implications for Research

The need for a student-centred approach to the teaching and learning of mathematics has been re-echoed explicitly in the new mathematics curriculum which was introduced in 2007. The new mathematics curriculum is underpinned by the principles of constructivism and aims at promoting students' active participation and engagement in the teaching learning process in Ghanaian Basic Schools. The underlining principle of the new mathematics curriculum is based on the premise that each individual student should be given the opportunity to be actively involved in the teaching-learning process (Ministry of Education, 2020).

Implementing and sustaining constructivism in Ghanaian mathematics classrooms is, therefore, problematic as the cultural orientations of the country do not encourage teamwork and acknowledgment of individual contributions in the teaching-learning process. Thus, the way forward is for teachers to be proactive in promoting classroom environments free from intimidation and fear. According to Parkinson (2009), the use of peer assisted learning support strategies will not only help in improving student performance but will go a long way in inculcating the culture of teamwork in classrooms. Considering the cultural and pedagogical orientations of the Ghanaian teacher, teachers, therefore, should be encouraged to develop their lessons in such a way that they are geared toward problem-solving to promote active learning. Tutors should therefore ensure that no matter the circumstances, teaching pedagogy used strongly encourage students' participation in class.

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