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Pre-Service Teachers' Perceptions of the Effectiveness of their Mathematics Tutors' Classroom Learning Environment Management Practices

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Abstract

The study explored pre-service teachers' perceptions of the effectiveness of their classroom-learning environment for learning mathematics, specifically, geometric transformation. The pre-service teachers' perceptions examined were confined to their tutors' support, equity, and task orientation during lessons on geometric transformation. Using a descriptive survey design, the views of 60 pre-service mathematics tutors, who were purposively sampled from three Colleges of Education in Ghana, were collected through a classroom learning environment management questionnaire. This instrument was adapted from the WIHIC Classroom Learning Environment Inventory which was used to collect data after the respondents had been taught geometric transformations in the colleges. The pre-service teachers' perceptions of mathematics classroom learning environment were gauged by their mean ratings of their agreement/disagreement with 5-point Likert scale statements about the subscales explored. The results show that there were only few of the statements about effective classroom learning environment management practices in the three subscales explored which the pre-service teachers rated above 3.5 on the5-point Likert scale. The overall mean score obtained on the ratings for tutor support (M = 3.20, SD = 1.456), teacher equity (M = 2.48, SD = 1.455) and task orientation (M = 2.48, SD = 1.455), suggest the pre-service teachers' perception of their tutors' effectiveness in managing the classroom learning environment was low or not good enough to enhance their learning of geometric transformations. This indicates the pre-service teachers' have a negative perception of the effectiveness of their tutors' classroom learning environment management practices to promote their learning of geometric transformations. It is recommended that CPD in the colleges should focus on enhancing tutors' or mathematics educators' classroom learning environment management practices in order to help pre-service teachers appreciate the learning of mathematics.

Keywords: pre-service teachers; classroom learning environment; learning environment management practices

Introduction

Mathematics significantly affects our way of life (Anthony & Walshaw, 2009). Just like any other discipline, it is more relevant due to its enormous contribution to education as a whole. Since mathematical knowledge is more important and widely used in all human endeavours, pre-service teachers who graduate the teaching of mathematics in schools, especially, the basic levels in Ghana from the Colleges of Education in the country. According to Toh, Chua, and Yap (2007), there has been a concern among teacher educators that these pre-service mathematics teachers might not have acquired an acceptable standard of understanding of mathematical contents and pedagogies when they are first deployed in schools. This reveals that prospective teachers need to be well equipped

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academically to confidently take the challenge of imparting unadulterated mathematical concepts to the younger ones. Because of this, the kind of classroom environment desirable for mathematics teaching and learning has interested researchers and many studies are being carried out to ascertain the effectiveness of such classroom learning environment management practices. It is the sole responsibility of teachers to play significant roles in the classroom during mathematics instruction to create an acceptable learning environment for students. Such a classroom-learning environment may change students' behaviour and perception that can be differentiated from the Co-ed situation.

Although geometric transformation is an important area in the colleges of education curriculum and much effort is exerted in teaching it. Evidence from numerous research studies makes it clear that many pre-service teachers' geometric transformation understanding is not at the level they need or are expected to be (Mitchelmore & White, 2000). A study conducted by Acquah (2011) on geometric transformations in Presbyterian College of Education, Akropong-Akuapem in the Eastern Region of Ghana revealed that only 26.5 percent of 200 pre-service teachers who took the examination on geometric transformation showed an average level of understanding. The remaining 73.5 percent were all below average. The study further reported that these pre-service teachers encountered many difficulties in other areas of reflection apart from the familiar mirror lines of $y = 0, x = 0, y = x, y = -x$.

Currently, a similar study conducted by Pinamang and Penrose (2017) also revealed that these pre-service teachers are weak in content and pedagogies concerning geometric transformation. These pre-service teachers, if nothing is done, may be the very ones who graduate as teachers and are likely to pass on the same weak content levels in the geometric transformation to pupils they may teach. The cycle of weak content levels would then continue from the primary through to the Senior High School to the Colleges of Education and even perhaps to universities. To Fraser (2012), one of the most influential factors in students' outcomes is the classroom-learning environment. The quality of classroom instruction is not only defined by the mode of instruction, subjects taught, or the level of achievement, but also by the kind of learning environment students and teachers may find themselves in, which may influence students' behaviour. In the Ghanaian context, the student-teacher relationship, the fear harbored by many students in mathematics, the psychosocial students' perception of their learning environment, and the fact that perception influences human behavior have all been hypothesized as the impediment to mathematics instructions as far as students' underachievement is concerned (Eshun, 2000).

This study, therefore, sought to find out how pre-service teachers perceive their geometric transformation classroom-learning environment and was guided by the research question: What are pre-service teachers' perceptions of their classroom-learning environment (i.e., in terms of teacher support, equity, and task orientation), for teaching and learning geometric transformation?

Theoretical Framework

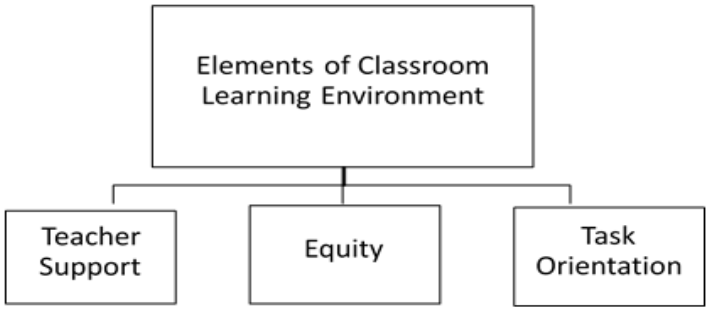
Our physical environment is often seen as the learning environment. To Frazer (2012), it encompasses all the social, psychological, and pedagogical contexts, which have implications on students' cognitive and affective domains. Students do not only interact within these environments but also, react to whatever situation they may find themselves in. In addition, Taylor (2004) reiterated that, these classroom-learning

environments are created based on similar perceptions form in the minds of both students and teachers. This means that classroom-learning environments are not individually created but by all those who find themselves within such environments. Such a learning environment must be teacher supportive, task-oriented, and foster equitability and cohesiveness. Several studies have hypothesized that; students perceive their classroom-learning environment to be conforming to such learning environments (Koul & Fisher, 2005; Taylor, 2004). Moreover, Brekelmans, Sleegers, and Frazer (2001) investigate students' perceptions of their classroom learning environments using various instruments. One of such instruments is the What Is Happening In this Classroom (WIHIC) instrument. The WIHIC instrument comprises seven subscales - teacher support, equity, task orientation, involvement, cohesiveness, investigation, and cooperation (Taylor, 2004). Although the WIHIC instrument has seven subscales, only three of the subscales are explored in this study as shown in Figure 1 and the elements of classroom learning environment (CLE) operationalized in Table 1.

Table 1 Operational description of the elements of classroom learning environment (CLE)

Sub-scale	Description	Sample Item
Teacher Support	The extent to which teacher helps, relate to, and show interest in their students	My mathematics teacher listens to and accepts my comments on how he/she teaches geometric transformation
Equity	The extent to which learners view the treatment they receive from the teacher to be the same	My mathematics teacher treats me the same way he/she treats other pupils in his geometric transformation class.
Task Orientation	The extent to which learners are made aware and perform tasks in the classroom	I know what I am trying to do in my geometric transformation classroom

Figure 1 Some elements of the classroom learning environment explored in the study



earlier found out that, students' stronger perception of their teachers' influence certainly increases the rate at which teachers get their students to participate in the teaching and learning process. These influences of classroom learning environment on students' performance have over the years called for several mathematics education researchers to

Methodology

The study was quantitative research that employed a survey as a strategy of inquiry. The population consisted of second year pre-service teachers taking a 4-year B.Ed Mathematics programme (junior high specialism) in the Central Region of Ghana. Two intact classes were randomly selected

from two Colleges of Education (i.e., College A and B used as pseudonym for ethical reasons) for the study. In all, 60 pre-service teachers were involved comprising 32 College A and 28 from College B.

A classroom learning environment management questionnaire, which was adapted from the WIHIC Classroom Learning Environment Inventory (CLEI), was used to collect data from the pre-service teachers sampled on their perceptions of mathematics classroom learning environment while being taught or learning geometric transformations in college. The pre-service teachers' perceptions of mathematics classroom learning environment were gauged by their mean ratings of their agreement/disagreement with 5-point Likert scale statements on the CLE elements or subscales explored (see Figure 1). Items obtaining a score less than 3.5 on the scale were labeled as being a negative on the construct whilst those items obtaining 3.5 and above were labeled as being a positive perception.

The overall means and standard deviations were also computed for each subscale to determine the pre-service teachers' perceptions on each of the subscales. A multiple regression analysis was also performed with a statistical package for social sciences (SPSS) to determine which of the three scales mostly influenced their perception of the geometric transformation classroom environment.

Results

Pre-service Tutors' Support

Pre-service teachers' ratings of statements in the CLEI's first subscale, designated tutors' support while teaching geometric transformations in college are presented in Table 2.

Table 2 Pre-service teachers' ratings of statements in the Teacher Support CLE subscale

Statements on Tutors' Support in the CLEI subscale 1	Mean	S.D.
a. The teacher moves about the class to talk when teaching geometric transformation	3.98	1.384
b. The teacher knows my problems in this geometric transformation class	3.72	1.427
c. The teacher helps me when I have trouble with the geometric transformation	2.92	1.576
d. The teacher takes interest in me in this geometric transformation class	2.82	1.513
e. The teacher's questions help me to learn in this geometric transformation class	2.57	1.382
Overall mean ratings	3.20	1.456

From Table 2, the two most common practices rated above 3.5 on the Likert scale which the respondents agreed the their tutor employed - "moves about the class to talk when teaching geometric transformation" (M = 3.98, SD = 1.384) and "knows my problems in this geometric transformation class" (M = 3.72, SD = 1.427). Except for these two statements, which had means above 3.5, the rest of the tutor support CLE subscale sentences yielded lower mean scores culminating into a low overall mean rating (M = 3.20, SD = 1.456) indicating that the pre-service teachers' perception of their tutors' support is low or not good enough to promote or improve their learning of geometric transformations.

Table 3 Pre-service teachers' ratings of statements in the Equity CLE subscale

Statements on Equity in the CLEI subscale 2	Mean	S.D.
a. The teacher answers my questions just as much as the teacher answers other students' questions in this geometric transformation class	3.57	1.307
b. I get the same amount of help from the teacher as do the other students in this geometric transformation class	3.20	1.325
c. I can talk the same amount as other students in this geometric transformation class	3.08	1.488
d. I get the same amount of encouragement from the teacher as other students do in this geometric transformation class	2.78	1.451
e. I am treated the same as other students in this geometric transformation class	2.48	1.455
Overall mean ratings	3.02	1.405

Equity in Pre-service Tutors' Classroom

The pre-service teachers' ratings of statements in the CLEI's second subscale, designated equity ensured by tutors while teaching geometric transformations in college, are presented in Table 3.

Table 3 shows the means and standard deviations of pre-service teachers' responses to statements on equity in the CLEI second subscale. The top most common practices rated above 3.5 on the Likert scale, which the respondents agreed their tutor employed - "answers my questions just as much as he/she answers other students' questions in geometric transformation class" (M = 3.57, SD = 1.307).

Except for this statement, which had mean above 3.5, the rest of the teacher equity CLE subscale sentences yielded lower mean scores culminating into a low overall mean rating (M = 2.48, SD = 1.455) suggesting that the pre-service teachers' perception of their tutors' assurances of equity are low or not good enough to promote or enhance their learning of geometric transformations.

Pre-service Tutors' Task Orientation

The pre-service teachers' ratings of statements in the CLEI's third subscale, designated task orientation of their tutors while being taught geometric transformations in college are presented in Table 4. The table shows the means and standard deviations of pre-service teachers' responses to statements on task orientation in the CLEI third subscale. The top three most common practices rated above 3.5 on

Table 4 Pre-service teachers' ratings of statements in the Task Orientation CLE subscale

Statements on task orientation in the CLEI subscale 2	Mean	S.D.
a. I pay attention during this geometric transformation class	3.73	1.413
b. I try to understand the work in this geometric transformation class	3.55	1.556
c. I know how much I have to do in this geometric transformation class	3.55	1.466
d. I do as much as I set out to do in this geometric transformation class	3.35	1.363
e. I am ready to start this geometric transformation class on time	3.35	1.260
Overall mean ratings	3.51	1.412

the Likert scale, which the respondents agreed their tutors used were - "answers my questions just as much as he/she answers other students' questions in geometric transformation class" (M = 3.73, SD = 1.413); "I try to understand the work in this geometric transformation class" (M = 3.55, SD = 1.556); "I know how much I have to do in this geometric transformation class" (M = 3.55, SD = 1.466). Except for these statements, which had mean above 3.5, the rest of the tutors' task orientation CLE subscale statements yielded lower mean scores culminating into a low overall mean rating (M = 2.48, SD = 1.455) suggesting that the pre-service teachers' perception of their tutors' task orientation was low or not good enough to support or enhance their learning of geometric transformations.

Discussion

The results suggest the pre-service teachers' perception of their tutors' effectiveness in managing the classroom learning environment was low or not good enough to enhance their learning of geometric transformations. The negative perception about the mathematics classroom learning environment was with all of the three subscales explored – teacher support, equity, task orientation. These findings contradict those of Koul and Fisher (2005) and Taylor (2004) that students found their classroom environment to be more task-oriented, teacher supportive and equitable.

These results actually indicate how these pre-service teachers perceive the treatment they receive from their tutors to be the same which accounts for the poor performance they demonstrate on task in geometric transformations. In this regard, Brekelmans, Sleegers, and Fraser (2001) pointed out that stronger perceptions of teachers' influences, increase according to the rate at which teachers get their students to be involved in the teaching-learning activities. Also in a recent study by Yılmaz & Malone (2020) on how Pre-service teachers perceive their learning environment after they were exposed to the blended learning approach, the results came out that, pre-service teachers have a positive perception about their classroom learning environment.Again, findings from the study conducted by Opoku, Budu, Kemetse, Amponsah, & Donkor (2023) revealed a negative perception by pre-service teachers towards their classroom learning environment. To ensure pre-service teachers have a positive perception of their tutors' classroom-learning environment management practices, the latter must consciously plan to get all engaged through equitable distribution of tasks and supports in order to get all involved. The more teachers get their students to be actively involved in classroom tasks, the more they perceive their teachers to be supporting them.

Conclusion

Students' perception is not independent of the classroom environment. The classroom environment significantly determines the direction of students' achievement. However, there might be several factors contributing to students' perception but teachers' support, task orientation, and equitability in the classroom are some of the key factors to consider as far as students' perception is concerned. How students perceive their classroom environment has a strong implication on their performance. Tutors must therefore be encouraged to ensure a serene and conducive classroom-learning environment that fosters maximum teacher support, good orientation to tasks, and equity.

Recommendation

Since the pre-service mathematics teachers indicated that the level of teacher support, task orientation and Equity among themselves in their geometric transformation classroom learning environment were above average,

mathematics educators at the colleges of education must be encouraged to create more suitable classroom atmosphere to foster teaching and learning of mathematics at the colleges of education level.

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