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Classroom Practices that Exist when University In-Service Students Teach Informal Geometry

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Abstract: ***This study examined classroom practices that existed when university in-service students taught informal geometry to pre-school children aged 5-6 years in ten pre-school centres annexed to government schools. The classroom practices examined focused on teacher subject matter knowledge and pedagogical content knowledge and the factors that affect these practices such as class-size,teaching materials, time,strategies,methods and approaches. The philosophical assumption employed was realism using the qualitative lens. The sample was selected using an explanatory sequential design.The methods used for data collection were document analysis,classroom observations,interview and a video. Data was analysed thematically. The findings were that teachers had challenges employing play based pedagogy due to large class size,no assistant teachers,insufficient materials, classroom space for setting corners,unsupportive management and administration , limited time of 30 minutes , lack of professional development,minimal subject matter and pupil absenteeism. The study recommended that, assistant teachers and other helpers need to be attached to these schools, commercially produced materials such as computers need to be provided by relevant authorities, school managers need to be oriented to early childhood provision,professional development be provided to relevant teachers, school health nutrition programme to be extended to early childhood children especially in underpriviledged communities,Early childhood learners be provided with permanent classes,videos be used to assess classroom practice.***

Keywords: Classroom practices, informal geometry, subject matter knowledge,pedagogical content knowledge

1. Introduction

Classroom practices is a way in which effective teachers combine classroom strategies and teaching practice as well as the way in which they utilize relationships with pupils,colleagues and school leaders in order to strengthen their overall presence in the school and classroom (Alison Kington, Elaine Regan, Pam Sammons & Christopher Day,2012;Yeping Li & Helia Oliveria,2015).This classroom practice as a process is affected by external and internal factors or agents such as class-size,materials for teaching and learning, time, approaches, strategies and methods. In the act of teaching informal geometry two important things interact thus Subject matter Knowledge (SMK) and Pedagogical Content Knowledge (PCK). Although these two practices may be affected by teacher quality.

Teaching requires the ability to see the informal geometrical possibilities in a task, sizing it up and adapting it for a specific group of students. Familiarity with the trajectories along which fundamental informal geometrical ideas develop is crucial if a teacher is to promote students' movement along those trajectories if at all they exist as in number and notation. In short, teachers need to muster and deploy a wide range of resources to support student's acquisition of informal geometrical proficiency.

2. Statement of the Problem

Classroom practice as a process,involves multiple agents and their interactions within the classroom as a system. The process can be manifested in diverse formats and structures, and its effectiveness can be influenced by numerous factors both internal and external to the classroom. And yet there seems to have been no research on classroom practice at teacher education level at University T even after the implementation of the ECE school syllabus in 2013. Even at major conferences like international Congress of Mathematics Education (ICME) there has been an absence of many studies on classroom practice. Yeping Li and Helia Olivia (2015) reports that,

Although it has long been recognized that research on classroom practice is important, large-scale systematic research on classroom practice in school mathematics is a relatively new endeavour. In fact, this Topic Study Group is only the second time in the ICME history to take a primary focus on classroom practice.

If teacher classroom practice is not checked, teachers will have difficulties on how to design learning environments, how to frame questions that suggest the value of re-thinking what is taught in informal geometry, how informal geometry is taught and how informal geometry is assessed and the problem of underperformance in geometry will not be resolved. And if this underperformance is not resolved, it may have a negative effect on Science, Technology and engineering courses in the country.

3. Purpose of the Study

This study was undertaken to examine multiple agents under lesson implementation,methods and techniques and factors that affect effective classroom practices such as class-size,teaching materials, time,strategies,methods and approaches that exist when university in-service students teach informal geometry so as to ascertain their adequacy and their effect on informal geometry education.

Research Questions

1) What classroom practices do university students use in teaching informal geometry?
2) How adequate are these classroom practices?
3) What is the effect of these classroom practices on how informal geometry is learnt?

Research Objectives

1) Examine classroom practices that university students use in teaching informal geometry.
2) Explore the adequacy of classroom practices in the teaching of informal geometry.
3) Explore the effect of these classroom practices on how informal geometry is learnt.

4. Literature Review: Classroom Practices, Adequacy and Effect

A few studies have analyzed classroom practice (Yeping Li and Helia Olivia, 2015). MCS study examined curriculum topics and course level of an algebra I or geometry course, it did not measure how well the curriculum was implemented in the classroom. The current study looked at how curriculum for early geometry is being implemented in early childhood education classrooms by teachers. Amah Robert Benjamin and Philip Siaw Kissi (2019) investigated teaching strategies used by college of education geometry tutors in Ghana while the current study is focused on university in-service students who were to start a course of instruction in informal geometry who were at that particular time enrolled in the first cohort of the first ever bachelor's degree programme in early childhood education to be offered at a government University. Umah and Kissi (2019) found that despite so much research (Alex and Mammen,2016;Howse and Howse,2015;Mostafa,Javad and Reza,2017) on the importance of adopting the Van Hiele model based on classroom practice ,the current study found none of such research in the literature. This study further used mixed methods to examine and explore university in-service teachers' classroom practices. In Amah and Kissi (2019) study college tutors were found to be using route learning methods, using textbooks to present theorems and proofs and that most proof exercises given to the pre-service teachers were not challenging enough to compel pre-service teachers to engage in effective reasoning while the current study has found university in-service teachers to be complaining about insufficient information in the textbooks and the syllabus and when given challenging work they cannot do it as most of them did not pass mathematics.

Musingafi, Mhute, Zebron, Kaseke (2015) also found that in Zimbabwe students could not distinguish between curriculum and syllabus.The quartet recommended that a successful formal teaching and learning process, that, requires proper selection and arrangement of the teaching items or materials is the way to go. They anchored that selection and sequencing of learning content and methodologies thereof should take place in the curriculum, syllabus, scheme of work and lesson plan stages. They argued that the distinction between these educational terms is largely on the degree of generalness, specificity and the stage at which it occurs.

Amah and Kissi (2019) found that tutors were not able to logically apply concepts. Amah and Kissi (2019) recommended that, tutors should adopt a model based teaching strategy that are supportive and involve more hands on investigations that will actively involve pre-service teachers. Lecturers should use realia and model-based instructions such as the most recommended model of van – Hiele (Alex and Mammen, 2016; Howse & Howse, 2015; Mostafa, Javod & Reza, 2017). This is because although most of the teaching takes place between the student and the problem in the text mediated more or less by the teacher. The more is characterized by the advanced mathematics teacher who runs his course by asking students on the how of doing that and getting the relevant postulate or definition. When students have gone as far as they can go and reached that critical junction, the teacher asks them to give a possible next step; then follows that up to see where it will lead, identifying the fallacy in the process, then backs up again for another suggestion until someone makes the right one.

However,Keith Jones (2014) warns that, that the development of effective teaching methods for geometry has been the subject of debate for some considerable time. This has been demonstrated by the numerous inquiries into the teaching and learning of geometry. The reasons for these inquiries are numerous but revolve around the lack of success in teaching geometry and the difficulties in designing a suitable geometry curriculum for schools. A particular problem is that the school geometry curriculum, for so long dominated by proofs in the Euclidean tradition, has been found to be wanting. Despite the efforts of people like Harold Fawcett (1938) in the 1930s, and many others, the general situation, as Howson (2000) attests, has been that Euclid-style' geometry is found extremely difficult and often uninteresting by most students. Indeed, research studies carried out at a time when proofs in the Euclidean fashion dominated school geometry (for example those by Williams, 1980, and by Senk, 1985) provide evidence across a wide range of schools of how little those pupils who followed such a geometry curriculum could do at the end of their course. The reasons for this lack of success in teaching geometry, particular when the geometry curriculum is dominated by proofs in the Euclidean tradition, are plentiful. For example, with respect to the teaching of proof the cumulative research evidence suggests that students fail to see a need for proof because all too often they are asked to prove things that are obvious to them (Jones and Rodd, 2001; Dreyfus, 1999). Another major problem, as identified by the ICMI study, is that, unlike in number and algebra, a simple, clear, hierarchical path from first beginnings to the more advanced achievements of geometry …. has not yet been found - and perhaps does not exist at all" (Mammana & Villani, 1998). This means that the relations between intuitive, inductive and deductive approaches to geometrical objects, the use of practical experiments, and the age at which geometrical concepts should be introduced, are far from clear.

Vogt Franziska,Bernhard hauser, Rita Stebler, Karin Rechsteiner and Christa Urech (2018) said that, taken that challenging, appropriate and adaptive mathematical learning opportunities are needed for kindergarten and educators need to decide on the best approaches to support the acquisition of these competencies in kindergarten. Schuler (2008) lays out several decisions, which educators face, among them the decision between an instructional programme versus free learning arrangement; specific fostering of children at risk versus fostering for all children; focusing on domain specific competencies only versus a broader approach. This means that informal geometry

teaching was not at the centre of curricular attention in kindergarten and educators emphasized a situated approach whereby mathematical competencies are applied to everyday situations. However,the emphasis on early learning leads to a shift in kindergarten practice. A range of learning materials are available,many of them requiring a specific time frame for focused informal geometrical activity,many of them designed as training programme,with a set order of units and exercises focusing on defined skills to worked through in the given order,delivered in an educator led instructional group setting. Hauser (2005) said that,the rise in instructional,school-like training programmes for kindergarten raises the question,whether a highly educator-centred,instruction-focused approach is best suited for children of kindergarten age or whether a play-based approach would be appropriate.

According to Hauser, innovative approaches to early mathematics including informal geometry should not only be developmentally adequate and effective, but also compatible with kindergarten pedagogy. As kindergarten children are highly motivated to learn, but not in a formal, instructional way, play can be regarded as a powerful vehicle for learning. Play can be defined as activities that are fun, voluntary flexible, involve active engagement, have no extrinsic goals, involve active engagement of the child, and often have an element of make-believe (Weisberg, Hirsh-Pasek, and Golinkoff, 2013)

Play and playfulness are at the core of early childhood education (Singer, 2013), although educators are not always aware of their role in fostering play (Bodrova, 2008; Vu Han, and Buell,2015). It is important to distinguish between activities which are play-based and adult- initiated activities, which resemble school-like tasks (Bergen, 2015). Wood (2009) highlights the need to distinguish between the different forms on the continuum between free play and no play. Such a clarification is sought with the concept of guided play. Guided play sits between free play and direct instruction and consists of adults structuring the play environment but leaving control to the children within the environment (Weisberg etal, 2015).

Innovative approaches to early informal geometry could draw on play,be it be role-play (Van Oers,2010) or board and card games. It needs to be recognized that role play, or pretend play requires much time for children to set up the play-frame, to engage with the play and develop it (Bergen,2015). As for board and card games,several studies found them to be effective in the acquisition of mathematical competencies (Gasteiger,2015;Jorn etal,2014;Kamii and Kato,2005; Ramani and Siegler,2008; Schuler,2013). Gasteiger, Obersteiner, and Reiss (2015) highlight that not only the concept of play is deployed differently, but also games consequently they propose a continuum from games designed for the purpose of entertainment only to targeted instruction with only few entertaining features. Four aspects are essential to play based approaches to informal geometry in early childhood education: the informal geometry content needs to be part of the mechanics of the game; needs, facts, concepts, outcomes to be correctly presented; essential for further learning and informal geometry games needs to be appropriate for the individual learning needs of the child.

What should be born in mind is that, although play is widely acknowledged as an important learning path in early childhood education, little is known about the effectiveness of play in comparison to other ways of learning in early childhood education settings. The research presented here examined classroom practices that existed when teachers teach early childhood informal geometry lessons.

***Time*:** Engel et al (2016) found when Engel et al linked the time spent on mathematics generally with children's mathematics achievement. According to him he found no correlation between the two constructs. Engel Et al (2016) concluded that educators focus on curricular content, which is not sufficiently challenging for most children for instance counting and shapes. Mathematical learning opportunities are needed which are challenging, appropriate and adaptive to the heterogeneous needs of young children. As sarama and clements 2009 highlight, the aim is to foster overarching mathematical competencies, which are core for mathematics and in line with children's thinking. Educator's belief are likely to influence the teaching of informal geometry in early childhood education. Their feelings of self-efficacy regarding mathematics is related to the importance they assign to the subject in kindergarten (Brown 2005).Educators might be worried that informal geometry is not fun and express negative feelings towards mathematics generally, possibly this is shaped by their own, often negative, school experience (Anders and Rossbach,2015). However, still on time some teachers said time is not a factor when the teacher knows exactly what s/he is expected to do in a lesson. As long as the teacher has planned effectively and consulted widely the issue of time does not matter. Chen etal 2014; Thiel, 2014 indicated a positive attitude towards mathematics among early years educators. Link, Vogt and Hauser (2017) found a comparison of educators' beliefs regarding fostering mathematics in kindergarten between Austria, Germany and Switzerland that the Swiss educators agree more strongly to an intentional approach to mathematics in kindergarten than the German and Austrian educators.

***Class size*:** Diane Whitmore Schanzenbach (2019) analysed the effect of class-size on teachers. In her analysis Schanzenbech (2019) said that small classes are better for children in early grades and children from low-income families though it is impossible to say what class size between 15 and 40 is ideal. She went on to say that before class size is reduced solutions should be found for children who want to join in the middle of the term, twins that cannot be split, building sizes and preparation of new budget amidst a tight budget of course not forgetting the effect of Corona Virus 19 pandemic (World Health Organisation-(WHO,2020) & Ministry of Finance (MoF,2020)

A randomized study conducted by researcher Helen Pate Bain and her colleagues in Tennessee in the mid-1980s, called Project STAR (1985-1990), provided the strongest evidence to date that children learn more when they are in smaller classes.The researchers randomly assigned nearly 12,000 students and their teachers in kindergarten through third grade in 79 schools to classes with 13-17 students or 22-25 children.The results were clear: students in the smaller classes performed significantly better on mathematics and

reading tests, with a gain of 4 percentile points or more. The benefits of smaller classes were even larger in schools with low-income children.

Recent research indicates that the benefits of being taught in smaller classes persist long after students have moved on to the next grade. They become more likely to complete high school and go to college and less likely to end up becoming parents in their teens, to name some of the most compelling examples.Many other researchers who have studied the impact of smaller classes in Wisconsin (Alex Molnar,Philip Smith, John Zahorik-1999) , Sweden (Peter Fredriksson,B Jorn Oskert, Hessel Oosterbeek-2013) and Israel (Joshua D. Angrist & Victor Lavy-1999) have found similar connections.But the evidence is not entirely clear cut. Although most research points to children faring better when they're taught in small classes, some studies (Hyunkuk Cho, Paul Glewwe,Melissa Whitler-2012) have not found any benefits.

There's a big gap in the research examining the effect of large numbers of children on teachers. Most studies have looked into how class size affects learning in elementary school, providing little insight (Thomas S Dee & Martin R West,2011) when administrators and policymakers make decisions about class sizes for middle and high school children.What should be born in mind is that many factors influence informal geometry educational outcomes. For example, total spending, class size and teacher quality are important. So is a school's culture, including how school staff work together and learn from each other, and how they respond to children's needs. The characteristics of a child's classmates matter, as does the fit between the child and her teacher. The reality is that, reducing the number of students in each classroom requires employing more teachers, which in turn, means spending more money on salaries and benefits. In some cases, the additional teachers hired may not be as effective as those already in the building. Strictly limiting class size can also drive up school construction costs when there aren't enough classrooms to accommodate students being split into more groups.It's also impossible to maintain consistent sizes in classes, especially in the early grades, since elementary schools tend to be relatively smaller. Let's say a school had 71 children aged 5 to 6 years, with a class size cap of 24. They could group them into two classrooms of 24 students and another with 23. But if the next term a family with twins moves into a nearby neighborhood, raising the number of children to 73, the school would wind up with three classrooms with 18 children and another with 19.

Taking that step instead of splitting them into two classrooms of 24 students and another with 25 could require hiring a new teacher. School administrators might argue in this situation – correctly – that one additional child would not make much of a difference in terms of what those 5-6 year olds would be learning that year. At the same time, those children could wind up benefiting from having fewer classmates.

***Materials*:** After identifying the high failure rate of pupils at grade seven level which recorded zero percent pass rate since 2013 in Zimbabwe, Paul Mupa and Tendeukai Isaac Chinooneka (2015) were prompted to investigate why there is such decay in schools in Zimbabwe. The duo used mixed methods to collect data and found out that teachers do not employ a variety of teaching methods. They do not prepare a variety of media for use in the teaching and learning. Teachers' instructional materials are limited to textbooks and syllabuses and do not go beyond that. Pupils learn in harsh and unconducive teaching and learning environments and there is low morale among teachers. Parental support in terms of extra materials such as text books and revision books is very low. Only a small proportion of parents' guide their children on homework. They do not provide extra lessons for their children. Schools lack adequate textbooks, revision books and resource books to extend children's knowledge. The effect of this is that teachers spend more time preparing materials at the expense of teaching. At times making of teaching materials takes up even the teachers free time. Teachers have no time to rest. And at times teachers are stressed up.

Some people believe that effective teaching takes place if teachers have been exposed to the foundations of education. Philosophy of education is central to the practice of teaching. In this regard, Kagan (1990, p.85) suggested that, "as we learn more about the teacher, we are likely to come closer to understanding how effective teachers are made". Knowledge of effective pedagogical practices including classroom practices seem to be topical in coming up with the profile of effective teaching. Paucity of material resources is a factor that contributes to ineffective teaching in early childhood education centres. Chingos & West (2010) argue that the quality of learning materials such as textbooks is an important ingredient in improving instructions. It is not the buildings themselves that are critical for effective teaching and learning but the quality of the processes that take place within the buildings (Butts, 2010). Physical infrastructures will have an impact if they prevent work from being done. Peterson (2009) has blamed the dramatically lower number of learning hours in developing countries. Students standing in lecture rooms without being able to take lecture notes impacts negatively on the quality of education. Sawchuck (2011) has found high correlation between electricity in the school and pupils achievement

5. Theoretical Framework

The model of mathematics knowledge for teaching (MKT) was used in this research. This model is thought to be one that connects knowledge and practice (Von Christopher Gulpric Chua (2018). The model may be used to revamp the curricula for teacher content preparation, inform professional development practices, and advance the understanding of the inter connections among teacher knowledge,teaching and student learning. It is a model that was born out of Shulman's (1986) pedagogical content Knowledge and later analysed and refined by Ball,etal (2008 & 2011)

This model was best suited for this study in the sense that, for one to effectively understand classroom practices one needs to understand how knowledge has shifted from an emphasis on understanding how teachers knowledge develop to how this knowledge is used in and for teaching (

Ball et al, 2008). Conceptualising teacher knowledge is a complex issue that involves understanding key underlying phenomena such as the process of teaching and learning, the concept of knowledge, as well as the way teachers' knowledge is put into action in the classroom

The study focused on how teachers structure teaching of informal geometry concepts and skills around problems to be solved (Checkly, 1997; Wood & Sellars, 1996; Wood & Sellars, 1997) ,how teachers encourage children's to work cooperatively with others (Johnson & Johnson, 1975; Davidson, 1990), how they use group problem-solving to stimulate children to apply their informal geometrical thinking skills (Artzt & Armour-Thomas, 1992); how children interaction in ways that both support and challenge one another's strategic thinking (Artzt, Armour-Thomas, & Curcio, 2008) ; how activities are structured in ways allowing children to explore, explain, extend, and evaluate their progress (National Research Council, 1999).

This was because in the art of teaching, there are three critical components to effective mathematics instruction (Shellard & Moyer, 2002): thus, teaching for conceptual understanding; developing children's procedural literacy and promoting strategic competence through meaningful problem-solving investigations.

6. Methodology

Mixed approaches were used. The researcher first got permission from the permanent secretary in the Ministry of Education to systematically sample ten (10) Early Childhood centres annexed to primary schools from the fifteen schools that provided early childhood education at the time of the study.The District education board secretary and the Provincial education Office were informed through the District Resource condinator. The actual population of the centres was accessed from the directorate of early childhood Education in the ministry of education. Headteachers, deputy headteachers,senior teachers and Teachers were briefed on the purpose of the study. The sampling procedure used was explonatory and purposive in nature with a realist paradigm touch. The research was cross-sectional as the teachers observed were not the same teachers on which the questions were administered during the residential. Observation instruments, document analysis and video recordings were used to find out how teachers understood how children learn, how they taught and factors that affected classroom practice. Data was analysed using themes**.**

7. Findings of the Study

7.1 Classroom practices, adequacy and effect

The students in this study were confusing the syllabus with the curriculum. This study further found that pre-service teachers could not recall geometric concepts which were taught at early childhood education level. This was inferred from their pedagogical content Knowledge that was at 50 percent. Students were also not able to logically apply concepts. This was shown in the group activity given to students during the residential. In this activity, students could not define certain concepts and could not tell on how they introduce informal geometry. In this study an eclectic/mixed approach to classroom practice is being advocated for.

In the current study no final assessment scores were collected from another source but all analysis was based on the prevailing conditions at institution T and the schools were some of this teachers had come from. It was assumed that, for one to practice as an ECE teacher, they had basic secondary school knowledge.

The frequency of active learning incidents was also collected during classroom observations. The qualitative phase was conducted as a follow up to the quantitative results to help explain the quantitative results.

Competence in class practice were affected by factors such class size, time, materials, content , methods, strategies and approaches. Teachers in the current study showed interest in using play based pedagogy but said that they do not really understand what this pedagogy is all about in the teaching of informal geometry.
This study has further found that in country Z until 2013 no standard instructions were given on early childhood provision. But this standards although were rolled out in other parts of the country, teachers were left out until late in 2019 when a workshop was held at L School. And yet is densely populated. But even if such an initiative was taken,the focus was not purely on mathematics and in particular the teaching of informal geometry. So whatever was done in other provinces might not be a true representation of the actual practice in L pertaining to the factors that affect effective classroom practice and at University T.

Class size**:** Teachers in this study complained of large class sizes .They said that large numbers of learners in class make it difficult for them to really teach informal geometry appropriately. These big classes stress them a lot especially that they are lone teachers without adequate materials and support from other members of staff. They said that as if this is not enough, the government is also asking them to implement play based learning as outlined in the Education curriculum framework (ZECF, 2013).

Time**:** Teachers said the time given to them is not sufficient to teach informal geometry in an integrated manner. However, still on time some teachers said time is not a factor when the teacher knows exactly what s/he is expected to do in a lesson. "*As long as the teacher has planned effectively and consulted widely the issue of time does not matter*,"that's what some teachers said.

Materials**:** This study found that compounded with large class sizes, time and new pedagogy being emphasized on without adequate continuous professional development, teaching and learning materials especially factory made materials was a challenge.

This study also found that, at the time this study was carried the early childhood syllabus had domains such as plane shapes; Sub domains-*lines and shapes;* specific outcomes-*trace different types of lines, identify basic shapes;*

knowledge-*tracing outlines of different types of lines, basic shapes;* skills-*coordination of the eye and hands to trace, coordination of the eye and hand in colouring;* values-*self confidence in drawing lines and colouring, appreciation of shape (Zambia Pre-school syllabus,2013)* . While the teacher education syllabus 2015 had the following aspects *plane, solid shapes and pedagogy; outcomes-describe plane and plane shapes, describe parallelism and properties of quadrilaterals, triangles, other polygons and circles, explore symmetry in regular polygons; outline properties of various solids including :cuboids, cubes, pyramid and cone; demonstrate knowledge on terminology related to plane shapes and solids and demonstrate ways for learners to explore plane shapes and solids; implementation at pre-school level-learners play with different assorted shapes, play with jigsaw, play with small mirror to explore symmetry, construct different shapes using building blocks(block play),manipulate and play with physical objects such as balls and mobiles.*

The content in the teacher education syllabus (2015) and lecturers guide seemed not to be enough.The teacher education syllabus (2015) did not have the following topics: *Development of spatial awareness, geometrical intuition and visualization; theorems and proof; conjectures, postulates and deductive reasoning; modelling ;information and communication technology geometric contexts; history and culture heritage of geometry; aspects of school geometry-points, lines, construction, loci, areas of plane figures and areas and volumes of solids; Theories and research related to concept formation in geometry; conceptualizing and enhancing pre-school teachers knowledge for teaching geometry (Levenson Esther, Dina Tirosh and Pessia Tsamir,2011) and how to conduct professional development of pre-school teachers geometry, learning trajectories* just to mention a few.

8. Discussions of the study

The students in this study were confusing the syllabus with the curriculum.This finding was consistent with what Musingafi, Mhute, Zebron, Kaseke (2015) found when they did a study in Zimbabwe.

This study further found that pre-service teachers could not recall geometric concepts which were taught at early childhood education level as their pedagogical content Knowledge was at 50 percent. This finding is consistent with what Amah and Kissi (2019) said. But Amah and Kissi differ with the current study in the sense that in the current study it is the students who could not define certain concepts and could not tell on how they introduce informal geometry. In Amah and Kissi (2019) it was recommended that,tutors should adopt a model based teaching strategy that are supportive and involve more hands on investigations that will actively involve pre-service teachers. Lecturers should use realia and model-based instructions such as the most recommended model of van –Hiele (Alex and Mammen, 2016; Howse & Howse, 2015; Mostafa, Javod & Reza, 2017) while in the current study an eclectic/mixed approach to classroom practice is being advocated to.

However, even if an eclectic approach is being advocated for in the current study, as by 2014 Keith Jones warns that, that the development of effective teaching methods for geometry has been the subject of debate for some considerable time. This has been demonstrated by the numerous inquiries into the teaching and learning of geometry. The reasons for these inquiries are numerous but revolve around the lack of success in teaching geometry and the difficulties in designing a suitable geometry curriculum for schools. A particular problem is that the school geometry curriculum, for so long dominated by proofs in the Euclidean tradition, has been found to be wanting. Despite the efforts of people like Harold Fawcett (1938) in the 1930s, and many others, the general situation, as Howson (2000) attests, has been that Euclid-style' geometry is found extremely difficult and often uninteresting by most students.

Adequacy of Classroom Practices

Competence in class practice pertained to processes on how the teacher taught based on SMK and PCK and how factors like class size, time ,materials, content , methods, strategies and approaches affect the teaching . Teachers in the current study showed interest in using play based pedagogy but said that they do not really understand what this pedagogy is all about in the teaching of informal geometry. This finding is not in line with what Vogt Franziska,Bernhard hauser, Rita Stebler, Karin Rechsteiner and Christa Urech (2018) said. The quartet said that, taken that challenging,appropriate and adaptive mathematical learning opportunities are needed for kindergarten and educators need to decide on the best approaches to support the acquisition of these competencies in kindergarten.

***Time*:** This finding differs with what Engel et al (2016) found. When Engel et al linked the time spent on mathematics generally with children's mathematics achievement.according to him he found no correlation between the two constructs. Contrary to what teachers complained about,Engel Et al (2016) concluded that educators focus on curricular content,which is not sufficiently challenging for most children for instance counting and shapes. However,still on time some teachers in the current study said time is not a factor when the teacher knows exactly what s/he is expected to do in a lesson. As long as the teacher has planned effectively and consulted widely the issue of time does not matter. This finding is in consistence with what other findings indicated. Chen etal (2014) & Thiel (2014) indicated a positive attitude towards mathematics among early years educators. Link,Vogt and Hauser (2017) found a comparison of educators beliefs regarding fostering mathematics in kindergarten between Austria,Germany and Switzerland that the swiss educators agree more strongly to an intentional approach to mathematics in kindergarten than the German and Austrian educators.

***Class size*:** Teachers in this study complained of large class sizes .They said that large numbers of learners in class make it difficult for them to really teach informal geometry appropriately. These big classes stress them a lot especially that they are lone teachers without adequate materials and support from other members of staff. They said that as if this is not sufficient,the government is also asking them to

implement play based learning as outlined in the Education curriculum framework (ZECF,2013). This finding is consistent with what Diane Whitmore Schanzenbach (2019) analysed. In her analysis Schanzenbech (2019) said that small classes are better for children in early grades and children from low-income families though it is impossible to say what class size between 15 and 40 is ideal. She went on to say that before class size is reduced solutions should be found for children who want to join in the middle of the term, twins that cannot be split,building sizes and preparation of new budget amidst a tight budget of course not forgetting the effect of Corona Virus 19 pandemic (World Health Organisation-(WHO,2020) & Ministry of Finance (MoF,2020)

Many other researchers who have studied the impact of smaller classes in Wisconsin (Alex Molnar,Philip Smith, John Zahorik-1999) , Sweden (Peter Fredriksson,B Jorn Oskert, Hessel Oosterbeek-2013) and Israel (Joshua D. Angrist & Victor Lavy-1999) have found similar connections.

But the evidence is not entirely clear cut. Although most research points to children faring better when they're taught in small classes, some studies (Hyunkuk Cho, Paul Glewwe,Melissa Whitler-2012) have not found any benefits.

However, this study concluded that, many factors influence informal geometry educational outcomes. For example, total spending, class size and teacher quality are important. So is a school's culture, including how school staff work together and learn from each other, and how they respond to children's needs. The characteristics of a child's classmates matter, as does the fit between the child and her teacher.

The reality is that, reducing the number of students in each classroom requires employing more teachers, which in turn, means spending more money on salaries and benefits. In some cases, the additional teachers hired may not be as effective as those already in the building. Strictly limiting class size can also drive up school construction costs when there aren't enough classrooms to accommodate students being split into more groups.

It's also impossible to maintain consistent sizes in classes, especially in the early grades, since elementary schools tend to be relatively smaller. Lets say a school had 71 children aged 5 to 6 years, with a class size cap of 24. They could group them into two classrooms of 24 students and another with 23. But if the next term a family with twins moves into a nearby neighborhood, raising the number of children to 73 , the school would wind up with three classrooms with 18 children and another with 19.

Taking that step instead of splitting them into two classrooms of 24 students and another with 25 could require hiring a new teacher. School administrators might argue in this situation – correctly – that one additional child would not make much of a difference in terms of what those 5-6 year olds would be learning that year. At the same time, those children could wind up benefiting from having fewer classmates.

***Materials*:** This study found that compounded with large class sizes,time and new pedagogy emphasized on without adequate continuous professional development,teaching and learning materials especially factory made materials was a challenge. This finding was consisted with what Mupa F (2015) found in Zimbabwe when Mupa carried out a study in primary schools.

The effect of this is that teachers spend more time preparing materials at the expense of teaching. At times making of teaching materials takes up even the teachers free time. Teachers have no time to rest. And at times teachers are stressed up.

Conclusion and Recommendations

Classroom practice pertained to actual classroom teaching and some of the factors that affected effective teaching such as class size, teaching resources,time, management , administration, approaches,strategies and methods. This study has found that classroom practices may have an effect or no effect teachers understanding of informal geometry. This paper illustrates that good practices that draw on the use of powerful informal geometry tasks alongside with approaches that promote students' autonomy and critical orientation in solving problems are key in improving childrens performance.

Therefore, this paper recommends:

- That a model of numeracy whose elements comprise mathematical knowledge, dispositions, tools, contexts, and a critical orientation to the use of mathematics, and applied to analyze changes in one teacher's planning, classroom practice, and personal conceptions of numeracy could be adopted.
- In order to reduce on the stress pre-school teachers are being subjected to assistant teachers and other helpers need to be attached to schools, materials especially commercially produced such as computers need to be provided by relevant authorities.
- School managers need to be oriented to early childhood provision so that they can start appreciating what is really involved in early childhood education as some of them have never practiced at that level but are really interested in understanding what this new sector is all about.
- Professional development be provided to the relevant teachers.
- School health nutrition programme be extended to early childhood children especially in underpriviledged communities to reduced on absenteeism
- Early childhood learners be provided with permanent classes.
- Technology should be introduced in early childhood education.
- New analytical tools (such as a video to be analysed by both the trainer and the train) should be used to investigate classroom practice. This will enable trainers and trainees to have a better picture of what is happening in the classroom and show a deep concern for acknowledging the teachers/lecturers' work.
- Micro and macro pedagogy should be used in teaching at the university to enable high quality learning in informal

geometry to carter for teachers with high subject matter and low to medium subject matter. This applies to teachers with low and high pedagogical content as well.

- Instructional materials in informal geometry should be revised so as to meet international standards

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