Geometry is regarded as more complex even though it appears less abstract than the rest of mathematics to teach and learn. The main aims of geometry are the development of thinking abilities of spatial intuition about the world, knowledge necessary to study more mathematics as well as the ability to interpret mathematical arguments. Research highlights the direct relationship between teachers’ competency in teaching geometry and quality of education. It is also argued that this relationship has more weight than any factor that impacts on education. Therefore, it is essential that professional learning as an important factor in teacher competency be given more attention if the quality of education is to be improved and achieved. In this regard, teacher competency is viewed as a pivotal link needed to ensure meaningful and sustainable change in high school mathematics teachers. This implies that teacher competency is the cornerstone for effective implementation of the teaching-learning plan that results in desirable teaching for learning outcomes. The purpose of this study was to investigate teacher’s competency in relation to other teacher competencies in teaching geometry in high school, Further Education and Training phase. In collecting data, constructs of Geometry Teacher Self-Efficacy questionnaire were used which include teacher competency relative to others. Quantitative data was analysed using SPSS. Participants were 81 high school teachers in South Africa, Mpumalanga and North West Provinces. About 61.7% of the teachers were men. Teachers ages range from 25 to 58 years (M= 43.0, SD= 7.78%). In terms of internal consistency, teacher competency relative to other teachers was .70. The result shows that 87.7% of the teachers revealed that they were able to adjust the approach when students experienced difficulties understanding geometry concepts. Approximately, 85.1% of the teachers indicated that compared to other teachers in their school, they felt that they were very effective teacher in teaching geometry. It is recommended that high school geometry teachers be exposed to professional development that focuses on content knowledge and pedagogical content knowledge as a way to enhance their competency perceptions in geometry teaching.

Keywords: Geometry, Teacher competency, relationship, high school.
type and gender, lack of technological knowledge [9; 10] were identified. This was important in this study because research shows that these challenges are linked to how teacher knowledge supports effective mathematics teaching [11]. Understanding geometry challenges assisted the researchers to understand Further Education and Training teacher competency in relative to others.

The purpose of this study was to investigate teacher’s competency in relation to other teacher competencies in teaching geometry in the Further Education and Training (FET) phase. In doing this, the construct of Geometry Teacher Self-Efficacy questionnaire was used relating to teacher competency in relative to others in teaching geometry.

2 RELATED WORK

2.1 Euclidean geometry education

It is argued that geometry at FET level is regarded as more complex even though it appears less abstract than the rest of mathematics to teach and learn [9]. The main aims of geometry are the development of thinking abilities of spatial intuition about the world, knowledge necessary to study more mathematics as well as the ability to interpret mathematical arguments [12]. Geometry is the bedrock of engineering and technological development [9]. In South Africa, geometry is part of mathematics and includes about 30% of the final NCS grade 12 paper [9]. Research shows that geometry is important in teaching because it offers the students the ability to think critically, solve problems and make use of the high level of thinking skills [13]. It is argued that teaching of geometry should constantly be innovated by introducing new methodical solutions [15]. In this case, the combination of van Hiele framework (1986) as well as Bloom’s (1979) taxonomy is observed as a partial solution into the teaching of geometry [9]. Furthermore, inquiry-based learning in high school geometry teaching and learning is also a proposed method [14].

2.2 Teacher competency relative to other teachers

It is pointed out that mathematical disposition and self-efficacy for teaching mathematics have a direct bearing on teachers’ views of themselves relative to their peers [8]. It is critical that the teachers develop skills to integrate new modes of teaching for learning strategies in their everyday teaching of mathematics [15]. In this regard, it is pointed out that teachers who are actively engaged in focused and appropriate professional learning have the potential to implement efficacy for learning strategies that create a balanced view on teachers’ competence relative to their peers successfully [7; 16]. These teachers compared themselves with their peers in terms of engaging students in the learning process; students shared their experiences and created a conducive environment for learning [17; 18]. These teachers were able to assist students to take ownership of their learning journey and not be afraid to act [19; 20; 21]. This implies that teachers felt competent relative to others by promoting student-centred approach as well as promote self-directed learning in geometry.

It is critical that mathematics teachers measure their competency to other teachers when they are given the opportunity to expose themselves to professional learning that would assist them to upgrade their professional knowledge and skills in teaching-learning plans, be involved in discussion with their peers, observe best practices, visiting other schools and participate in conferences and workshops [22] [11]. This measure can also be provided by the professional structure training programmes for pre-service and in-service training with the aim to encourage teachers’ perceptions of their competence relative to their peers [23] [16].

Alternative study describes the core competencies for educators as including the following: ability to interact well with students, creation of sustainability learning environment, good at lesson plan design, ability to use variety teaching strategies, ability to assess ability to identify students’ needs good communication skills, able to collaborate, ability to maintain a professional appearance as well as demonstrate a commitment to the profession [17] [14]. The competencies described by [17] [14] are comprehensive and all-inclusive, in terms of the classroom dynamics. One aspect that is evident is the need for the teacher to be an all-rounder in a classroom situation. Competency is no more being described in terms of the traditional key features that include content knowledge (CK) - the teachers’ knowledge of how to teach specific content, the academic knowledge of teachers as a subject specialist. Pedagogical Content Knowledge (PCK) or General Pedagogical Content Knowledge - a teacher’s understanding of the range of teaching, assessment, classroom organization but it also needs to include: Knowledge of Context (KoC) - the teacher’s knowledge of the specific context in which teaching takes
place [18] [17]. This study acknowledges the importance and relevance of the context’s knowledge if a teacher is to be successful in teaching Euclidean Geometry at the high school level.

2.3 Mathematics teaching strategies

The effective mathematics approaches that enhance mathematics self-efficacy teaching are critical in a school environment since they are inter-connected [24] [12]. However, as a result of complexity in mathematics approaches, it is critical that the teachers develop skills to integrate new modes of teaching for learning strategies in their everyday teaching of mathematics [25] [13]. In this regard, it is pointed out that teachers who are actively engaged in focused and appropriate professional learning have the potential to implement efficacy for learning strategies that create a balanced view on teachers’ competence relative to their peers successfully [24] [9]. These teachers compared themselves with their peers in terms of engaging students in the learning process; students shared their experiences and created a conducive environment for learning [17] [14]. These teachers were able to assist students to take ownership of their learning journey and not be afraid to act [25] ([15]). This implies that teachers felt competent relative to others by promoting student-centred approach as well as promote self-directed learning in geometry.

3 METHOD

In order to answer the research question: What are the teacher’s competency in relation to other teacher competencies in teaching geometry in high school? A quantitative approach was employed. Data were collected by means of Geometry Teacher Self-Efficacy questionnaire. For the purpose of this paper teacher competency relative to others, the construct was used. Data were analysed using SPSS. In analysing data, descriptive statistics related to frequency, percentage mean and standard deviation were used.

3.1 Participants

Cluster sampling was used to select the participants. Participants were 81 grade 12 mathematics teachers in South Africa, Mpumalanga and North West Provinces. These teachers attended a professional development programme in 2015 at a university in South Africa. Table 1 shows the biographical data of the 81 teachers who participated in the study. It may be observed from Table 1 that the majority (61.7%) were men. The teachers’ ages ranged from 25 years to 58 years (M = 43.0 years; SD = 7.78). In terms of teaching experience, it ranges between 1 – 20 (M=10.3, SD=6.78). Most of the teachers 70.4% had a degree in teaching.

| Biographical data of the teachers according to gender, age and teaching experience. (N = 81) |
|---------------------------------------------|-----|-------|-----|-----|
| Gender                                       | N   | %     | M   | SD  |
| Women                                        | 31  | 38.3  |     |     |
| Men                                          | 50  | 61.7  |     |     |
| Age                                          |     |       | 43.0| 7.78|
| 20 – 29                                      | 5   | 6.2   |     |     |
| 30 – 39                                      | 19  | 23.5  |     |     |
| 40 +                                         | 57  | 70.3  |     |     |
| Teaching experience                          |     |       | 10.3| 6.78|
| 1 – 9                                        | 40  | 49.4  |     |     |
| 10 – 15                                      | 24  | 29.6  |     |     |
| 16 +                                         | 17  | 21.0  |     |     |
| Degree                                       |     |       |     |     |
| Yes                                          | 57  | 70.4  |     |     |
| No                                           | 24  | 29.6  |     |     |
3.2 Instrument and procedure

The Johnsons’ Geometry Teacher Self-Efficacy questionnaire (GTS-EQ) [6] was used. It comprised of four constructs. For the purpose of this paper, Teacher Competency Relative to other Teachers was used. The teacher competency relative to others had four items. Teachers were requested to respond to items statements by registering their choices on a Likert type scale. Here, the purpose was to investigate the teacher’s competency in relation to other teacher competencies in teaching geometry in high school. Teachers had to rate their responses in a Likert-type scale ranging from 1 = Strongly Disagree to 4 = Strongly Agree. Some of the typical statements from teacher competency relative to others were:

- At school, my colleagues come to me for help in geometry
- Compared to geometry teachers in my school, I am a very effective teacher
- Compared to geometry teachers in my district, I am a very effective teacher

4 RESULTS

It was found that the internal consistency of teacher competency relative to other teachers was .70. In terms of item 1: At school, my colleagues come to me for help in geometry. It may be observed from the results in Figure 1 that most of the teachers 86.5% strongly agreed to agree to this statement. This suggests that their colleagues consulted them for help with geometry.

In terms of item 2: Compared to geometry teachers in my school, I am a very effective teacher. The results in Figure 2 shows that most of the teachers 90% strongly agree to agree to this statement. This suggests that the majority of the teachers revealed that as compared to other teachers at their school, they are very effective in teaching geometry. They were flexible in their teaching approach.
In terms of item 3: Compared to geometry teachers in my district, I am a very effective teacher. The results in Figure 3 shows that the majority of the teachers 96.3% strongly agree to strongly agree with this statement. Here, the majority of the teachers felt that they were very effective teacher in their district as compared to other teachers.

Figure 2. Teachers’ ratings of their views of being effective teacher in teaching at school

In terms of item 4: Individual differences among teachers account for a wide variation in student’s geometry achievement. The results in Figure 4 shows that 73.8% of the teachers indicated that the statement was disagreed to strongly disagree. It may be observed that below three quarter of teachers indicated that they were not effective in attending to students’ individual difference and apply a wide range of approaches to assist the students to increase their academic performance compared to other teachers.

Figure 3. Teachers’ ratings of their views about being effective as compared to others in the district
5 DISCUSSION

In terms of the scores from the GTS_EQ, reliability was computed through Cronbach’s alpha (Cronbach, 1951). The alpha value was 0.70 for teacher competency relative to other teachers and this is regarded as acceptable. It may be argued that teachers in this study. It may be argued that the geometry teachers in this study were available for help and advice for other teachers with geometry related problems. It may be argued that these teachers were knowledgeable about the subject and had qualifications in mathematics. Furthermore, it may be argued that these teachers always attended professional development. This is supported by [26] who revealed that mathematics teacher professional development programmes assist teachers in transforming their teaching practices. It is critical that teachers constantly consider professional learning [27]. They also had more experience in teaching geometry. This is supported by the number of years of experience found in this study that 50.6% of the teachers their experience ranged between 10-20 years. It is argued that through experience a successful math teacher has an extensive knowledge of mathematical concepts such as geometry which allows him/her to confidently explain concepts and processes to students [28].

It was also found that most of the teacher felt that they were effective in their school in teaching geometry because their students’ academic performance improved and they were willing to learn and participated in class. It was clear that these teachers applied a variety of teaching and learning strategies that encourage active learning. This implies that teachers incorporated the theory of social constructivism where students actively engage and constantly constructing and reconstructing knowledge through environmental interactions [29]. These teachers allowed students to work in groups, participated in discussions when solving the problem. Research shows that these strategies encourage collaborative learning which is beneficial to teachers and students [30].

With regard to teachers comparing themselves with teachers in their district, it was found most of the teachers were effective in doing this. This implies that when these teachers attend mathematics district meeting or geometry workshops, they tend to be coordinators. Also, their positive contribution and discussion in the workshops made them realised that they were effective in the district. These teachers also performed very well in geometry. It was also found in this study that they were not effective in attending to students’ individual difference as compared to teachers from another district. They find it challenging to attend to students’ individual differences.

6 CONCLUSIONS

It may be argued that teachers in this study were successful in teaching geometry because they demonstrated the passion and interest with the subject. It may be observed that teacher competency in relative to other teachers proved to be more effective in their school, districts and supporting other teachers. It was found that teachers were less effective when it comes to attending to students’ learning
preferences. As much as they involved and promoted problem solving and collaborative skills, but they could not support each learner to achieve this according to his/her understating.

7 RECOMMENDATION

It is recommended that high school geometry teachers be exposed to student approaches to learning as well as various learning preferences tools. This will enable them to understand the students’ and provide the learning environment that is conducive to each other.

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