Applying Bandura's Theory of Self-Efficacy to assess the perceptions of Pre-service Economics teachers concerning teaching using graphs

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Abstract

This qualitative study examined the Self-efficacy perceptions of preservice economics teachers regarding teaching with graphs. Understanding graphs have a major role in future teaching practices however learners find it challenging understanding economics graphs. Using a structured interview of 55 pre-service secondary school teachers, economics self-efficacy items by Bandura self-efficacy framework was used to analyze the data. The study found that student teachers are not confident to teach using graphs but have positive attitude to learn how to plot and interpret graphs. The teaching practices of high school teachers were found to have influenced the low-self-efficacy of most of the participants though they look forward to teaching using graphs. Most participants agreed that plotting, understanding, and interpreting data from graphs as well as presenting information graphically are key skills that all economics teachers and students should master. The research concludes that both high school economics teachers and preservice teachers should be equipped with necessary skills to understand graph presentation because they both grapple with interpreting and plotting graphs. The research contributes to improving the way graphs are taught because economics teachers must be comfortable with graphs presentations. Higher education institutions should increase their effectiveness when teaching introductory economics courses by finding creative ways to help students understand graphical representation of economics content. It is recommended that Teacher Education programs should emphasize the importance of graphs in the teaching of economics and empower student teachers with the necessary skills.

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Introduction

Given the challenges faced by preservice teachers in understanding graphs in economics, it is important to understand the self-efficacy of pre-service economics teachers in teaching with graphs. Plotting, understanding, and interpreting data from graphs as well presenting information graphically are key skills that all educators and students should master (Angra & Gardner, 2016). Teaching and learning with graphs are fundamental to knowledge-driven applications especially to a subject like Economics that integrates theoretical skills, calculation, graphs, tables and equations to answer questions (Cohen, & Flood, 2022). However, the successful fulfilment of this task or duty depends on the self-efficacy, motivation, and self-confidence of teachers (Altunoğlu, Kurnaz, & Sexton 2022).

Although graphs are perceived as essential, students have problems in almost all aspects of graphs, such as reading graphs, drawing graphs, interpreting graphs, and converting one type of graph to another type (Boote, 2014; Capraro, Kulm, & Capraro, 2005; Koparan & Güven, 2013; Matuk et al., 2019; Oruç & Akgün, 2010). Even the simplest graphs are considered difficult by many people (Galesic & Garcia-Retamero, 2011 Gioka, 2007; Matuk et al., 2019). Researchers like Patahuddin & Lowrie, (2019) also noted that educators themselves require a robust understanding of graph knowledge to deliver this instructional implication.
Earlier researchers (Wainer, 1980; Fry, 1981; Friel & Bright, 1995) defined graphicacy as the ability to read and draw graphs, reading the link between the data (explaining the general information in the graph), and reading beyond the data (making comments and inferences about the graph). Ludewig (2018) sees graphicacy as the ability to create, prepare, present, read, and interpret graphs and as the ability to understand graphs independently of the specific content domain. Graphical knowledge enables students to clarify abstract relationships; causing a better retention of learnt concepts Moosavian (2022). In a hastily increasing world of knowledge, gaining graphing skills is essential because graphs act as an entrance gate to scientific studies (Bursal & Polat 2020). Limited research has been published on the effects of graphs on the teaching and learning of economics.

Research have shown that the use of graphs is amongst the most important forms of representation not only in the teaching of economics but also in other subjects like mathematics and science disciplines (Bautista et al 2015, Brückner, et al 2020, Klein et al 2020). “Teachers should engage students in using graphs to tackle a variety of situations, for example to find the solutions to word problems, to summarize datasets, to interpret relationships between variables, to examine and/or infer patterns, and to model situations” (Bautista et al 2015, p.92). Both preservice teachers and in-service teachers as well as learners should have adequate knowledge regarding the interpretation and reading of graphs (Celik 2022). Acquiring this knowledge requires an understanding of the level of self-efficacy to their competencies regarding interpretation and reading of graphs. It is noted that a strong predictor of behaviours in competent teachers is their self-efficacy (Palmer, et al., 2015).

Despite the need for teachers and pre-service teachers to be acquainted with the use of graphs, research has shown that pre-service teachers still experience challenges teaching with graphs. As a result, researchers have dived into understanding different aspect of economics graphs and the challenges they pose to Pre-service teachers. For example, Burdina & Sauerb (2015) investigated pre-service teachers’ misconceptions in graphs. Khoo & Fitzgerald (2017) investigated the graphical skills of Pre-service teachers. While Ogbonne (2022) explored pre-service teachers’ integration of technology to mitigate these challenges, Kurniawati (2020) argued that it is teachers’ lack of content knowledge that is responsible for the challenges in understanding graphs. The study argues that there is a gap in the literature that fails to account for Pre-service self-efficacy towards the teaching of economics graph.

Self-efficacy is an evaluation of one’s ability in executing a desired level of performance to achieve an ideal outcome (Bandura, 1997). Although limited studies (Acquah & Parthey, 2023; Suriamurthee & Kudayya, 2010; Winston & Francis, 2021) have investigated the self-efficacy of pre-service economics teachers, most of them have concentrated on teachers’ self-efficacy belief in classroom management. What is lacking in current literature are studies on pre-service teachers’ self-efficacy in the teaching of specific economics concepts such as graphs. This will inform teacher education in the teaching of graphs and assist in producing well-equipped teachers. It is based on this premise that the study aims to find how preservice teachers perceive graphs in the teaching of economics since the subject has a lot of graphical presentations which most students perceive as daunting.

To achieve this aim, the study adopted a qualitative method where structured interview of 55 pre-service secondary school teachers were used to collect data thus employing the Bandura self-efficacy framework to analyse the data.

The study is organized as follows; immediately after the introduction is the literature review. This is followed by the theoretical framework, the Research methodology, the findings and discussions and the conclusion.

The research question that will address the problem of this study is thus, what challenges do pre-service teachers have regarding the plotting and interpretation of economics graphs?

Literature Review

There is large evidence that proves that teachers have challenges using graphs to inform and guide their instruction (Guler, & Didis-Kabar, 2021; Delport, 2021; Gesel et al., 2021). Teaching with graphs should go beyond how to merely join points on the graphs but also how confident the teachers are in using it. In their study, Hafiyusholeh et al. (2018) found that student teachers had challenges in creating graphs. The study identified students’ challenges in the areas of incompetencies in reading, interpreting, and presenting data. In another study, Bektasli & Cakmakci, (2011) was concerned about student teachers’ challenges in plotting and interpreting graphs and found that students lack confidence and had anxiety when using graphs to teach. A further review of literature by Bursal & Yetis (2020) shows that students can read the graphs, but their interpreting and plotting the graphs were insufficient. Ozmen et al. (2020) carried out a study to determine the challenges of graphs for the eighth-grade students and drew attention to the fact that the students could not identify the incorrect graph types and the errors in the graph which calls for a concern. Patuhuddin & Lowrie (2019) examine teachers’ ability to interpret and plot graphs in their study and found that the teachers could not give high-level answers to the questions about interpreting and plotting graphs. In support of the above scholars is Bolch & Jacobbe (2019) who examined the graph comprehension of university students and opine that the students had challenges in answering questions about plotting graphs and making inferences from the graphs.

Acquiring graphical skills remains a key to understanding economics graphs. Graphical skills encompass graphical representation, presentation, interpretation, plotting, drawing of graphs. In their study, Guven et al. (2015) stated that students focused on a single variable when drawing graphs because they lack the skill of determining the type of graph suitable for the context. This view is also shared with Kotzebue, Gerstl, & Nerdel (2015) and Boote & Boote (2017) who found that student teachers are challenged when constructing graphs from data and in labelling axes or choosing the right graph type. Although the above literature seems to suggest
that students generally grapple with interpreting and plotting graphs, another aspect that pose challenged to student is lack of graphical skills. In another other study, Ben-Zvi & Makar (2016) viewed students’ development of their graphical skills as important in the teaching process and pointed out that the important role of teachers is emphasized in terms of how skillful they are in teaching graphs (Bursal & Yetiş 2020).

The knowledge of reading, interpreting, visualising and analysing graphs allows people to have a global view of many phenomena presented both numerically and graphically (Bruno & Espinel, 2009). It is therefore important to develop students’ graphic interpretation skills in subjects like mathematics, science as well as economics (Patahuddin & Lowrie, 2019). The ability to interpret graphs is considered a central facet domain in understanding information because it requires less cognitive energy when it comes to the interpretation of data (Moosavian 2022). Apart from that graphical presentation also accommodates a variety of learning styles at the same time engaging learners with different learning styles (Moosavian 2022). Using graphical representation of economics information has the potential to help students develop deeper understanding of economics concepts and relationships. This makes this study very significant because pre-service economics teachers need to be equipped with graphing knowledge so that they will be able to teach effectively.

Researchers have found that students often struggle to interpret line graphs or solve problems based on line graphs as well as mathematical concepts related to graphs, such as the graph slope (Christensen and Thompson, 2012; Planinic et al., 2012, 2013; Wemyss and van Kampen, 2013; Bollen et al., 2016; Ivanjek et al., 2016, 2017, Canham and Hegarty, 2010; Kragten et al., 2015; Miller et al., 2016).

Teacher education needs to address this problem by empowering pre-service teachers with graphical presentation skills. The ability to interpret and present information graphically is essential because this knowledge allows students to visualise economics concepts. Furthermore, graphs representation is important in the teaching of economics because it aims to represent socio-economic issues and relations of the real-world experiences in models which encourage reasoning. In general, graphs are used to simplify the presentation of (complex) concepts and to facilitate the exchange of information between individuals. Very limited research has been published on the self-efficacy levels of economics teachers on the teaching and learning of economics with graphs which makes this study very significant. The research utilised Bandura’s self-efficacy theory to find out how trainee teachers perceive the use of graphs in the teaching and learning of economics. The theory is discussed in the following section.

**Theoretical framework**

The study used the foundational constructs of Bandura’s self-efficacy theory to understand the perspectives of economics preservice teachers regarding teaching with graphs. Self-efficacy theory (SET) is a sub-category of Bandura’s (1986) social cognitive theory. Drawing from Bandura’s social cognitive theory, teacher self-efficacy may be conceptualized as the teacher’s beliefs in their own ability to plan, organize, and carry out activities that are required to accomplish given educational goals (Skaalvik & Skaalvik 2010). The theory therefore suggests that it is the duty of the government and society to offer everybody with adequate chances to engage in mastery experiences. In this study it is the duty of teacher education to equip trainee teachers with competencies to teach economics effectively. The theory further states that people are likely to participate in activities to the point that they perceive themselves to be proficient (Bandura 1999). It is also believed that self-efficacy concerns the degree to which people develop behaviours that allow them to persevere within potentially traumatic situations (Graham 2022). In this case teaching with graphs can be traumatic if instructors are not competent enough to present graphical presentations. Gallagher (2012) affirmed that individuals are able and capable of being successful, only if they have the opportunities and self-efficacy necessary to pursue their goals. Self-efficacy theory accentuates the importance of the individual and the individual's perceptions of his/her personal capabilities as key determinants of successful outcomes. In this research self-efficacy theory was found appropriate because it assisted in understanding the perceptions of preservice teachers towards the teaching of economics using graphs. The results will assist in improving the way graphs are taught because economics teachers must be comfortable with graphs presentations. The self-efficacy of the trainee teachers was assessed using the four constructs; enact mastery (performance outcomes), vicarious experience (self-modelling), verbal persuasion (verbal encouragement) and physiological arousal (emotional state). These four constructs were used to develop interview questions which were asked to preservice teachers. The four constructs of the adopted theory are presented in figure 1 below.
Figure 1: Sources of Self-Efficacy; Source: Self-Efficacy by Bandura (1977)

The first construct which is enact mastery (performance outcomes) is the belief that one can carry out the said task successfully, while vicarious experience (self-modelling) is the idea that one will perform the desired outcome if they have good role models. The third important source of self-efficacy is verbal persuasion which says that self-efficacy is influenced by encouragement and discouragement pertaining to an individual’s performance or ability to perform (Redmond, 2010). The fourth and last important source of self-efficacy is physiological arousal (emotional state) which is associated with the emotional, physical, and psychological well-being of a person can influence how they feel about their personal abilities in a particular situation. Interview questions asked to trainee teachers covered all these four sources of self-efficacy to tap into their views about teaching economics using graphs.

Research and Methodology

The study is qualitative in nature. Qualitative research focuses on observing and describing events as they occur, with the goal of capturing all the richness of the everyday behaviour Stangor (2011). The qualitative method was appropriate because researchers wanted to understand how trainee teachers perceive teaching economics using graphs. Trainee teachers were interviewed to gain insights into their experiences and perceptions of economics graphs. Data was collected using structured interview questions which were formulated using the constructs of Bandura’s (1977) self-efficacy theoretical framework. Structured interviews were thought to be more credible than semi-structured and unstructured interviews. Participants were presented with the same questions in the same order, which makes it easier to compare the answers. Structured interviews are reliable because the same interview can be repeated.

Target population

The target population for this study was the final year student teachers at a University of Technology in South Africa.

Sampling procedures

The sample consisted of 55 undergraduate third year preservice student teachers enrolled in an economics course. The reason why the researchers chose third year trainee teachers is that this level is the exit level. The researchers were eager to find out if at their exit level student teachers were confident enough to teach economics using graphs.

Data analysis Collection

Data was collected through a structured interview schedule which was distributed to 55 students, 32 females, 20 males and three unclassified. The interview questions were derived from the four self-efficacy constructs of Albert Bandura’s 1977 model, the theoretical framework which underpinned the study. Data analysis consisted of reading through each question’s responses several times and pulling text from responses.

Data analysis

Extracted data were analysed according to the four constructs of Bandura’s self-efficacy theoretical framework. To maintain privacy actual names were not used, SF and SM were used. SF for female students and SM for male students and numbers were also used.
For instance, S1F, meaning student 1 is female and S2M meaning student 2 is male. Participants answered questions related to Bandura’s self-efficacy constructs as alluded before. Three questions per construct were asked. We analysed each response given by all the 55 participants. The following sections present preservice teachers’ interview responses, analysed according to the four constructs of the theoretical framework.

**Construct 1: Enact mastery (performance outcomes)**

Fifty-five economics student teachers were asked to explain if they had problems with graphs. See responses of some of the participants:

S5M: “I have problems with plotting and interpreting graphs and not confident to teach using graphs”

S36M also added that he had insufficient competencies to teach using graphs: “I have challenges with plotting and interpretation of graphs. I did not teach graphs successfully during teaching practice.

Among the 55 students 16 of the students indicated that they had challenges with both plotting and interpreting graphs. Five students had problems with plotting and eighty students with interpreting. A total of twenty-nine (29) students had problems with graphs. Twenty-six (26) students said that they were comfortable with graphs. The study found a greater number of pre-service teachers had challenges plotting and interpreting graphs. This is of great concern because these students were in their final year.

**Construct 2: Vicarious experience (self-modelling)**

Twelve students said that they were not confident and not motivated to teach using graphs because they find graphs difficulty, and this discouraged them. Thirty-five students said that they were not confident but motivated to teach using graphs. Eighteen of them said they were discouraged by the way teachers presented graphs in schools.

S20F “Discouraged demotivated to teach using graphs because most teachers made it seem like graphs are difficulty to understand."

In supported S28F said that” Discouraged by the high school teacher who taught economics without graphs”.

**Construct 3: Verbal persuasion (verbal encouragement)**

Eleven students were discouraged because their high school teachers did not like graphs. One of the students shared said that:

S35? “High school teachers would skip all the topics with graphs or not present them, so we thought graphs were not that important, hence we are struggling”.

S19F “Discouraged, no lecturer or teacher taught how to understand graphs like them, so I am not motivated to appreciate graphs “

**Construct 4: Physiological arousal (emotional state)**

Students have mixed feelings, some are positive, and others are negative. Some of the responses given are:

S3F “I have a positive attitude towards teaching with graphs because graphs give an analytical explanation of economic events.”

S42F “I have a negative attitude because I easily forget the interpretation of graphs because, graphs are difficulty, and they need a lot of time to practice.”

Most of the students who are positive said that they needed to have a lot of practice and to be more attentive when graphs are being presented. Some students also showed concern that both teachers and lecturers were not patient with them. One of the participants said:

S19F “I am motivated, but I need a lecturer or a teacher who is patient to explain graphs step by step”.

Critical graph evaluation and effective teaching is needed so that student teachers will be able to teach confidently when confronted with issues revolving around the construction of graphs.

**Findings and Discussions**

Data analysis revealed that most students are not confident enough to teach using graphs. This is supported by several researchers. For example, studies conducted by (Bektaşlı & Çakmakçı, 2011; Beler, (2009); Coṣtu, (2007); Hotmanoğlu, (2014); Koparan & Güven, (2013); Oruç & Akgün, (2010) and other countries around the world (Beichner, (1994; Boote, 2014; Capraro et al., 2005); Gioka, 2007); Tairab & AlNaqbi, 2004) agree that students experience problems in all processes related to graphs, such as graph plotting, graph reading, and graph interpretation (Bursal & Polat 2020). For economics to be taught successfully student teachers as well as teachers in service should be able to draw and interpret graphs, read the link between the data, and to convert information into different graph types. Therefore, graph plotting, and interpretation should be taken seriously especially in Teacher Education programs.

The responses to the second construct (self-modelling) revealed that most teachers did not model the teaching of graphs well. Most pre-service teachers did not have good role models. S28F’s sentiment about graphs is in total agreement with Patahuddin & Lowrie,
(2019) who also noted that teachers themselves require vigorous training about graphs. It is fundamental for teachers to teach graphs well because preliminary skills about graphs are acquired during elementary school years, students' graphing skills are mostly acquired during the middle and secondary school years (Lai et al, & Linn, 2016; Phillips, 1997; Bursal & Polat 2020). Only eighty participants said they were confident and were going to teach successfully using graphs. This is a serious problem which Teacher education should put on top of each agenda. Economics, Science and Mathematics student teachers should leave teacher education institutions well equipped with the relevant knowledge to teach using graphs comfortably. Graphs should be taught well because graphs and other types of diagrams are an instructional method for representing both domain-specific and generic knowledge, they are the main focus in teaching, especially at the beginning of university studies (Heublein,2014; Lagingand Voldkamp,2017).

Lack of confidence in teaching with graphs is a clear indication that graphs are not taught well by most teachers and instructors. Self-confidence is conceptualized as the belief that one can effectively perform a desired action (Feltz 2007). The terms self-confidence and self-efficacy have been used to describe a person's perceived capability to accomplish a certain level of performance (Feltz & Chase 1998). The ability to interpret graphs is considered a central facet domain in understanding economics information. This agrees with research, which was done nearly two decades ago by Brewer, & Jozefowicz, (2006) who asserted that an urgent call was needed for teacher education researchers and other classroom researchers for more studies examining the impact of Professional Development (PD) programs on teachers’ instructional practices. Several researchers also emphasized the need for more studies focusing on the impact of PD on teachers’ instructional practices (Dede et al., 2009). Many studies have investigated students’ difficulties with graphs in disciplines such as mathematics and physics (Woolnough, 2000, Bautista, Cañadas, Brizuela, & Schliemann, 2015). Students’ understanding of graphs can improve after a targeted intervention Klein et al., (2015). In support Klein & Kuhn (2020) said that Higher education should increase their effectiveness when teaching introductory economics courses by finding creative ways to help students understand graphical representation of economics content.

A fair number of students took the blame upon themselves agreeing to the fact that they did not practice enough hence they perceived graphs as challenging. This agrees with Miller et al., (2016), who alluded that students do not spend sufficient time trying to understand the depicted concepts of graphs. While S3F’s response agrees with Fry, (1981); Shah & Hoeffner, (2002); Wainer, (1992) and Bursal & Polat (2020), who said that graphs have the advantage of summarizing data in a practical and visually comprehensible manner, hence they are used in teaching processes. Actively engaging in the stepwise process will increase students’ confidence with graphs and will enable them to critically think about their data and graphs within the classroom context and outside of the classroom (Angra & Gardner, 2016). This agrees with Celik (2022) who strongly stressed that teachers in service teachers should have adequate knowledge regarding the interpretation and reading of graphs.

Although graphs come across to students on many occasions, past studies reported that students experience various problems related to graphs (Gioka, 2007; Matuk et al., 2019). It is well documented that students have problems in almost all aspects of graphs, such as reading graphs, drawing graphs, interpreting graphs, and converting one type of graph to another type (Boote, 2014; Capraro, Kulm, & Capraro, 2005; Koparan & Güven, 2013; Matuk et al., 2019; Oruç & Akgün, 2010). An important cause of the lack of graphing skills of students is shown as the failure of the educational systems to deliver the necessary graphing skills at schools (Bowen & Roth, 1998; Gioka, 2007; Greenberg, 2014; Hotmanoglu, 2014; Taırağ & Al-Naqbı, 2004). This makes this study very significant because pre-service teachers need to be equipped with graphing knowledge. A number of participants also pointed out that in-service teachers should be workshopped regularly to equip them with new and relevant skills.

In a rapidly increasing world of knowledge, gaining graphing skills is essential because graphs act as an entrance gate to scientific studies (Bursal & Polat 2020). This is supported by Matuk, Zhang, Uk, & Linn, (2019) who alluded that graphs are crucial in each area of life, from sports to politics or from news to scientific publications, various types of graphs are presented.

**Conclusions**

This study examined the Self-efficacy levels of preservice economics teachers regarding teaching with graphs. Our findings showed that the student teachers are not confident but have a positive attitude to keep practicing how to plot and interpret graphs. It was also found that learning is influenced by the teachers’ self-efficacy levels. The absence of good models to model the teaching of economics using graphs is the missing piece in teaching economics effectively. About 30 participants pointed out that economics teachers in service need professional development through workshops. The idea that professional development (PD) can foster improvements in teaching is widely accepted in any profession. In this case economics teachers should be provided with professional development focusing more on improving their graphical presentations.

The implication of this study is that there is a need for teacher education programs to incorporate graph comprehension skills into their curriculum. Thus, this study contributes to the need for teacher self-efficacy in graphical presentation because graphicacy needs serious attention.

The study is however without some limitations, there a probability of potential bias in self-reporting during interviews. Also, the study is limited by the geographic focus which may have implications in generalising the findings of the study. However, the result can be used to infer the need to examine the self-efficacy of preservice teachers in other settings.
It is recommended that teacher education should regularly conduct workshops to keep in service teachers abreast with graphical presentations and other new types of teaching strategies.

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524


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