

**Blended Learning and Flipped Classroom
Approaches as Learning strategies in Electronic
Control and Digital Electronics at a Technical and
Vocational Education Training Institution**

by

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A dissertation submitted in partial fulfilment of the academic requirements for
the degree of Masters in Education
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ABSTRACT

In recent years, there have been great advances in technology, encouraging teachers to use technology to improve learning and understanding in their classrooms. As a result of these significant advancements in technology, specifically handheld devices, smartphones and wireless networks, blended learning can be used as an innovation in engineering classrooms in the vocational sector of South Africa. The flipped classroom approach has been increasingly used internationally; however, it is not well recognised and used in South Africa.

The main focus of this study was to examine whether a blended learning strategy that made use of the flipped classroom approach enhanced student learning in Electronic Control and Digital Electronics at a Technical and Vocational Education and Training (TVET) College. This study also aimed to improve my classroom practice, using an action research design. This study took place during the Covid-19 pandemic which highlighted the importance of using blended learning platforms during lock downs and social distancing measures at TVET Colleges.

This study was located within the critical paradigm and used an action research methodological approach. For this study, data was generated using various data generation instruments from a purposive sample of 12 Level 2 TVET College students. Data generation instruments included focus group discussions, questionnaires, a survey and an observation schedule. The theoretical framework adopted in this study was Garrison and Vaughan's (2008) community of inquiry framework which analysed the factors that affected learning.

Garrison and Vaughan's (2008) community of inquiry outlines three presences that are vital when using a blended learning model. These are the teaching, social and cognitive presence. Within each of these presences are factors that either hinder or enhance learning and teaching using the blended learning model. The factors associated with each presence were used to analyse data and contributed to the findings of this study. While literature highlighted factors that could have hindered this study, there were unique factors in this study as a result of the Covid-19 pandemic affecting the country.

The key findings of this study revealed that blended learning using the flipped classroom approach promoted flexible learning, enhanced collaboration and collaborative learning of both teacher and learners, and improved understanding and self-development. This study also found that while blended learning using the flipped classroom approach offered safety to teachers and


students during the Covid-19 pandemic, it was also compromised due to challenges related to connectivity and lack of resources. It is therefore critical that TVET Colleges take cognisance of how best to support lecturers to implement blended learning strategies that will enhance teaching and learning.

DECLARATION

Submitted in fulfilment/partial fulfilment of the requirements for the degree of Master of Education, in the Graduate Programme in Teacher Development Studies, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

I, Thirushen Odayar declare that

1. The research reported in this thesis, except where otherwise indicated, is my original research.
2. This thesis has not been submitted for any degree or examination at any other university.
3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
4. This thesis does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - a) Their words have been re-written, but the general information attributed to them has been referenced.
 - b) Where their exact words have been used, then their writing has been placed in italics, inside quotation marks, and referenced.
5. This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References sections.


Thirushen Odayar

Date

Dr J Naidoo

Date

DEDICATION

To my mother, my only parent, ‘Sushie Odayar’, for the loving encouragement and your unique support throughout my life. For inspiring me to study and achieve my highest possible academic level, therefore I would like to give her my special thanks.

To my late uncle ‘Danny Pillay’, I will always remember your words that asked me to challenge myself and kick started my academic journey and placed me on my path. I am beyond words to express my gratitude and appreciation that I will always carry with me.

My daughter ‘Thea Aria Odayar’, for making me smile and laugh and keeping me sane throughout this process. Thank you for your concern and your nurturing spirit during the long sessions.

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It is with sincere thanks that I acknowledge my dependence on my family for the completion of this dissertation.

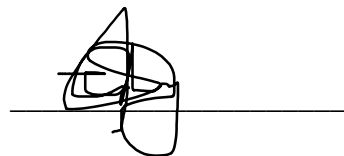
I further wish to extend my heartfelt appreciation to the following people:

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- My senior lecturer, Mr Viren Baijoo, Thank You for your understanding and encouragement throughout this period.
- Most importantly my family, whose continued encouragement and support got me passed the finish line.

PREFACE

The research study described in this dissertation was carried out with twelve learners at a Technical and Vocational Education and Training College. The data collection commenced in March 2020 and concluded in August 2020, under the supervision of Dr J. Naidoo of the Pietermaritzburg campus of the University of KwaZulu-Natal.

This study represents the original work completed by the author and has not been submitted in any form for any diploma or degree to any other tertiary institution. Where the author has made use of the work of other authors, this has been duly acknowledged in the text.



Thirushen Odayar

Date

As the candidate's supervisor I agree/do not agree to the submission of this dissertation.

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CHAPTER 1 - INTRODUCTION AND BACKGROUND

1.1 Introduction

Recent advances in technology have prompted teachers to use blended learning to improve understanding in their classrooms. The aim of this study was to examine the use of blended learning using the flipped classroom approach to enhance student learning and understanding in Electronic Control and Digital Electronics at a Technical and Vocational Education and Training (TVET) College. In addition, this study aimed to improve my teaching practice of basic electronic tools and measuring equipment, using action research. This chapter begins with an outline of the background and purpose of the study. This is followed by a discussion of the rationale, research questions and key concepts, conceptual framework and methodological approach. The chapter concludes with an overview of the dissertation chapters.

1.2 Background to the study

South Africa has faced many challenges post-apartheid, which includes large scale-unemployment, inequality and poverty. To help alleviate some of these issues and address the great skills shortage the country has faced, the government looked to TVET Colleges to address them. Akoojee (2016) contends that in 2001, 154 technical colleges were merged into the current 54 public colleges. This was done to address the skills needs of the economy and address the imbalance of the population's skills during apartheid. However, The National Development Plan highlighted the difficulties faced in this sector, these included being "too small, not effective" and the quality of learners being "poor" (National Planning Commission, 2012, p. 50). Similarly, there have been other policy papers that found that teacher ineptitude, insufficient receptiveness towards the needs of learners and poor resources could have contributed towards the poor quality of learners leaving these institutes (DHET, 2012b; Akoojee, 2008).

The White Paper approved in November 2013, regarding post education and training, was regarded as the vision of the South African government for post-school learners which outlined a crucial strategy for the way forward for TVET Colleges to 2030. Edigheji (2010) argues that

in a developing democratic country, education and training is vital for it to be regarded as successful. Therefore, having access to sustainable work and income increases the chances of reaching social development objectives of the country. The importance given to the role of education and training had been reinforced by national policy in South Africa. According to UNESCO (2007, p.2), the TVET learning system should help support public and individual work while advancing sustainable incomes since its learning structures develop both "soft and hard" skills. Similarly, Marope et al. (2015, p.13) affirm:

Since education is the key to effective development strategies, technical and vocational education and training (TVET) must be the master key that can alleviate poverty, promote peace, conserve the environment, improve the quality of life for all and help achieve sustainable development.

In South Africa, the curriculum utilised to provide vocational education is the National Certificate Vocational (NCV), which was established in 2007 by the Department of Education (DOE) as a comprehensive curriculum with 14 fields of study. According to Badenhorst and Radile (2018, p. 2) the aim of NCV was:

(1) to solve the problems of poor quality and low relevance of the previous vocational educational programmes which were offered; (2) to alleviate the chronic short supply of work placements available to students; and (3) to address the low technical and cognitive skills of graduates.

According to Badenhorst and Radile (2018), TVET Colleges have key challenges with lecturing capabilities of staff as well as the NCV program attracting learners with different levels of academic readiness, resulting in staff catering to dissimilar levels of learners in the same class (DHET, 2012a). Papier (2009) noted the unsatisfactory outcomes and miserable accomplishments of learners in the NCV program. Similarly, DHET (2012b) highlighted a national certification rate of 10 per cent in 2007 and a through put rate of 4 per cent in 2009.

Badenhorst and Radile (2018) concur that the challenges facing TVET colleges in South Africa are overwhelming, and that there is an absence of rationality creating a fragmentation in the organisation. According to Field, Musset, and Alvarez-Galvan (2014), this resulted in lecturers, learners, and prospective employers being disengaged in this sector. However, while vocational

quality flourished globally (Mohlokoane & Coetzer, 2007; Hallinger & Lee, 2013; Nkosi, 2012), the type of quality of vocational education in South Africa has put a question mark on its ability to address important issues in the country (Field et al., 2014).

Gewer (2010) and Akoojee (2016) describe numerous difficulties that learners and lecturers encountered in the TVET sector. According to Akoojee (2016), the funding system put into place for the TVET sector, encouraged colleges to increase numbers for monetary gain at a cost of quality. Other challenges included lack of learner capabilities, learners having different levels of academic knowledge in the same classroom as a result of colleges having no specific criteria or chose to ignore them for admission of learners. Despite these difficulties, lecturers were still required to obtain certain pass rates set by their colleges. Mitgang (2012) argues that changes needed to be made to the South African TVET College system in order to offer superior quality, distinguished, vocational education. Similarly, Akoojee (2016) affirmed that new approaches to learning programs and learning methods need to be adopted, which included flexible teaching times and forms of learning for TVET colleges to help alleviate some of the challenges facing the TVET sector.

I have also experienced these challenges in my teaching and workshops at the TVET College. Therefore, implementing new methods of teaching could be beneficial to me and the learners in my course. Hence, this study aimed to examine if blended learning using the flipped classroom approach could address some of the challenges facing learners, lecturers and TVET colleges in South Africa.

1.3 Purpose of the study

The purpose of this study was to examine whether blended learning using the flipped classroom approach enhanced student learning and understanding in Electronic Control and Digital Electronics. The topic of blended learning is very broad as there are many different approaches and methods which can be used. As a result, this study focused on the flipped classroom approach to blended learning at a TVET college. This approach created an environment where learning used the strength of face-to-face learning and online structures for a much richer learning experience than conventional teaching methods. As a result of the significant advancements in technology in the form of handheld devices, smartphones and wireless

networks, blended learning is an ideal innovation to introduce to engineering classrooms in the TVET sector. According to Thomas (2008), such innovations could lead to convenient, flexible, accessible and effective learning experiences for the new generation of learners entering schools of learning.

This study also aimed to improve my teaching practice using an action research design. The study examined how a flipped classroom teaching strategy stimulated students interest in this engineering module and improved their learning. By using a flipped classroom as a teaching strategy, I hoped to improve my teaching practice and students' engagement and motivation to learn on their own due to interest rather than being forced to learn due to assessment tasks. Sarsani (2008, as cited in Rinekevich, 2011) affirmed the above notion that students' dislike for certain subjects, improved as soon as they were introduced to new creative styles of teaching in those subjects. There is great importance for blended learning within the TVET sector in South Africa, as it could resolve problems faced by the massive expansion in the enrolment of learners and the mixed capabilities of learners in the classroom. The use of technology to teach and learn might appeal to the new generation of learners, leading to the improvement of learning and understanding and consequently improving the quality of learners leaving TVET colleges. Flipped classroom strategies are not widely recognised in TVET colleges in South Africa. Therefore, this study aimed to highlight the potential of flipped classroom strategies to lecturers and researchers in the TVET sector. Blended learning could also address some of the problems with a high number of registered learners and poor building infrastructures in South Africa. Although flipped classroom learning is widely adopted on a global level, is not well recognised in the South African TVET sector. The purpose of this research is to highlight awareness of its possibility in the vocational sector and to give it greater recognition (Ozdamli & Asiksoy, 2016).

1.4 Rationale

I teach Electronic Control and Digital Electronics at a TVET college. Reflection on my teaching highlighted that I had been using a teacher-centred approach. As an electrical subject specialist in an electrical infrastructure course in a TVET setting, I have observed learners having difficulties with the module: Basic electronic tools and measuring instruments. I was of the opinion this was due to the poor teaching strategies outlined in the subject guidelines. The

only teaching aid used was the textbook and students summarised the notes required. Reflection and inquiry have also made me aware that learners were missing lessons due to socioeconomic problems. There was no creative approach outlined in the subject guidelines for this module to inspire and stimulate the interest of learners. This resulted in learners not completing the work required to achieve the outcomes of this module. Consequently, I aimed to introduce blended learning using a flipped classroom approach to improve my classroom practice and make the learning journey in my subject beneficial and more creative.

As this is a vocational subject, this module comprises both theory and practical aspects. Vocational education attempts within a short period of time to prepare students to enter the practical setting of industry. The theory and practical aspects of this module are critical to the passing of the first-year course as well as the overall three-year course as they are both vital to learners' overall understanding when used simultaneously. This is of special interest, as DHET requires NCV learners to engage in practical lessons throughout the duration of the three-year course. The assessments for these practical tasks could contribute towards 60% of their final mark. Also, in order to do practical training, learners should have a solid grasp of the theoretical concepts. Learners continuously faced challenges when studying this module and achieved poor assessment marks. As a result, this motivated me to explore blended learning using a flipped classroom approach as an alternate teaching strategy to enhance my teaching practice and improve learners' understanding and pass rate in this module.

The teaching approach for technical education in South Africa has always had a substantial theoretical and deductive influence. Nevertheless, during the last ten years, the relevant departments of education have tried to move away from this, looking to other countries for inspiration on the direction vocational education should follow (RSA, 2006, 2012; ELRC, 2009; DHET, 2012, 2012a, 2012b, 2013;). As a result of different social and economic problems facing South Africa, adopting an approach used by first world countries for vocational education has been met with difficulties in the classroom by teachers (DOE, 2007). According to DoE (2005, 2007) and ELRC (2009), large class numbers and students with different entry-level knowledge made teaching and learning difficult for learners and lecturers. Textbooks and curriculum changes that have not accommodated these problems have also put pressure on lecturers as there has been a shift towards the quantity of learners passed and not the quality of the pass. The current pedagogical practices did not always help with these challenges.

However, Gewer (2010) contends that a key problem at TVET colleges was the lack of learner capabilities which was intensified by insufficient career guidance. Furthermore, learners enrolled for the same course from dissimilar grades which created dissimilar levels of academic knowledge in the classroom, since colleges had no specific criteria or chose to ignore them from the admission of learners. According to Akoojee (2016), this was the result of an obligation to increase the enrolment numbers at the cost of quality, which prevented real skills development. As a result, staff and management complained about the learners who were admitted into the programs not being adequately prepared at schools to complete the changeover into this curriculum and program. The diverse structure of courses resulted in some learners not grasping the content. These were some of the challenges faced by TVET college's staff and learners. With the large sums of money used to develop and improve TVET structures, Akoojee (2016) affirmed that a new approach to learning programs and learning methods be adopted, which included flexible teaching times and forms of learning. As a result, Akoojee (2016) mentioned the need for programs that used blended learning and distance learning to help cater for and improve learning issues of learners.

Bliuc et al. (2012) contend that for more than a decade, Australia used blended learning to address the challenges faced with regards to standards of education and its relevance to students and the workplace. They added that the key to success of the Australian vocational education system was the introduction of online learning which complemented face to face learning. Bliuc et al. (2012) further assert that with blended learning, workplace-based activities could be integrated into the educational design using online resources. Bliuc et al. (2012) argue that online learning is discipline-specific and extremely valued by future employers. This research study by Bliuc et al. (2012) elaborated on problems that are similar to what TVET colleges in South Africa are facing currently (Akoojee, 2016) and could be useful to examine how blended learning could address some of these challenges.

There have been numerous studies that highlight the benefits of blended learning in vocational education for learners, lecturers and the socioeconomics of the country. According to Butler and Brooker (1998, as cited in Bliuc et al., 2012), blended learning worked predominantly well in vocational education due to learners needing to apply abstract knowledge gained from vocational schools to a workplace setting. Ellis, Goodyear, Calvo and Prosser (2010, as cited in Yang, 2012) argue that there has been an increase in the use of blended learning in higher

learning as a result of the rapid advance in information technology. According to Graham (2006) and Morgan (2002), blended learning was one of the most effective current-day pedagogical instructions that could support peer learning, student-centred strategies and active learning. Moreover, Yang (2012) argues that using blended learning, that is, the interaction of online learning and face to face instruction, created a learning environment where students had flexible time to work at their pace on favourite modules or focus on their individual needs. A crucial element of blended learning is openness, meaning that education environments are inclusive, easily available and convenient. However, Liyoshi and Kumar (2008, as cited in Ruhalahti et al., 2017) maintain that educational sincerity also refers to open educational technologies, software and the sharing and construction of knowledge. Likewise, Özkan and McKenzie (2008) believe that open social software allows people to collaborate, interact and create extended online communities with ease in such environments.

Kosar (2016) affirms that blended learning as an approach could improve the quality of education. Boyle et al. (2003) highlight the effects of blended learning on student success rates. Moreover, Castelijns and Janssen (2008) and Boyle et al. (2003) contend that students who were introduced to blended learning had higher exam scores, higher average scores and a significantly higher percentage pass when compared to those in the traditional teaching groups. Pereira et al. (2007) affirm that blended learning was more effective than traditional teaching. Furthermore, Liu et al. (2007) assert that learners who engaged in blended learning achieved better learning performance and reported higher levels of satisfaction than their counterparts who received traditional classroom-based training. Pereira et al. (2007) and Yushau (2006, as cited in Shen et al., 2011) conclude that blended learning was more effective than traditional teaching. Ruhalahti et al. (2017, p.378) argue that “a powerful blended learning design can be achieved by using online affordances to facilitate students’ learning in their physical environment”. This not only emphasises the advantages of using blended learning strategies but also the challenges facing TVET Colleges. Akoojee (2016) elaborates on this: firstly improvement in teaching practice and self-development, secondly learner academic development and personal growth and thirdly, better quality graduates to address skills shortages currently facing South Africa.

Finelli, Daly and Richardson (2014, as cited in Seniuk, Ingram, Friesen and Ruth, 2017) argue that despite the substantial growth in engineering education and the advancements made in engineering, not enough progress has been made to assist new and more successful teaching

pedagogies in this field. Vocational education teachers in South Africa have more than thirty learners in a classroom but have to use a curriculum and teaching approach designed for fifteen learners. Seniuk et al. (2017) argue that due to these difficulties' teachers adopted the deductive teaching approach where a more teacher-centred approach was followed. Similarly, Mathieson (2015, as cited in Seniuk et al., 2017) agrees that there was a large gap between learning outcomes and teaching practices.

The preceding discussion alludes to the many teaching and learning challenges that lecturers and learners faced in vocational education in TVET colleges. This study seeks to examine whether blended learning using a flipped-classroom approach could address some of these challenges and improve teaching and learning in a TVET classroom. Findings from this study could assist DHET to design relevant professional development programmes for lecturers, which could improve lecturer's propositional knowledge of their subject and assist them to improve their teaching practice and learner capabilities. Campbell et al. (2006, p.161) concur that "... to mobilise teachers' pedagogical content knowledge for change in their classroom behaviour, a robust knowledge and understanding of school subject content is required".

The research studies I reviewed elaborated on learners' and teachers' perceptions, attitudes or views on blended learning and flipped classroom approach (Graham, 2006; Morgan, 2002; Ruhalahti et al., 2017; Bliuc et al., 2012; Flipped Learning Network, 2014; Mason et al., 2013; Enfield 2013; Ferreri and O'Connor, 2013), as well as the benefits of using blended learning and a flipped classroom approach in vocational education (Flipped classroom offers, 2011; Gallagher, 2009; Cole & Kritzer, 2009; Gannod, Berg & Helmick, 2008). It is evident that research studies highlight the learning effectiveness of a flipped classroom approach in modern day teaching (Dabbagh and Kitsantas, 2012, McLoughlin and Lee, 2010; Zhai et al., 2017, Hao, 2016). Some research studies compare blending at different levels of education and how it could increase flexibility for both the lecturer and learner (Boelans et al., 2017; Mazer et al., 2007; Osguthorpe and Graham, 2003; Graham, 2006). On the other hand, there are studies that explain challenges that could be faced when using blended learning and the flipped classroom approach (López-Pérez et al., 2011; Graham, 2006; Porter et al., 2016; Zhou & Xu, 2007; Ngimwa & Wilson, 2012; Swan, 2009; McCann, 2010). These studies emphasise the gaps in the TVET sector, namely poor peer learning, not enough learner centred strategies, poor active learning strategies, learners with different learning capabilities and diverse prior knowledge in the same class and large classroom sizes. Therefore, I envisage that this research study would

address this gap and shed light on the use of blended learning using a flipped approach to improve teacher practice and development as well as learner understanding and learning in a TVET classroom.

1.5 Research Question

This study was guided by the following research question:

To what extent does blended learning and a flipped-classroom approach enhance students' learning in basic electronic tools and measuring equipment in Electronic Control and Digital Electronics level 2 at a TVET College?

1.6 Theoretical Framework

The theoretical framework adopted in this study was the community of inquiry theory. This framework helped to establish blended and online learning settings by mixing the social dimension with community and inquiry. Garrison and Vaughan (2008) argue that in any community a social dimension exists, however, they explain that in an academic environment, collective construction of meaning and critical thinking is essential in a community of inquiry. Moreover, it is argued that for online learning to be profound and deep, social presence, cognitive presence and teaching presence elements must interact and overlap. To counter the challenges and issues that blended learning encountered, Garrison et al. (2010) were inspired to create an online learning research tool for a framework. According to Garrison (2009, p.61), the framework is made up of the following “three elements—social, teaching and cognitive presence—as well as categories and indicators to define each of the presences and to guide the coding of transcripts.”

At the interface of cognitive, social and teaching occurrence, the Community of Inquiry (COI) model can be used to explain how a group of people learn in this educational experience. Similarly, Garrison et al. (2010) argue that a group of individuals in an educational community of inquiry can engage and cooperate to confirm mutual understanding and create personal meaning for the purpose of reflection and critical discourse.

Furthermore, Garrison et al. (2010) explain how each of these essential elements consists of two parts, namely, the design element and the student experience. According to Garrison et al. (2010), design element for **teaching presence** consists of motivating, building understanding and instructor guidance while the student experience consist of focusing, discussion, sharing personal meaning and defining and initiating discussion. For **cognitive presence**, the design element needs to propose solutions and question or challenge exploration of problems whereas the student experience must share connecting ideas, apply new ideas and have a sense of perplexity information. Lastly, the design elements for **social presence** need to have collaboration and a communication cluster however the student experience needs to express views encouraging collaboration for the appreciation of learning opportunity. The three components of the community of inquiry framework, namely, the social, teaching and cognitive presence as well as the design element and student experience were used to analyse data in this study.

1.7 Methodological approach

This study was underpinned by the critical paradigm. According to Patton (2002), the key idea when using the critical paradigm, is to bring change to the situation and not just try to understand and explain society. The critical paradigm has sometimes been referred to as a transformative paradigm since it aims to bring about change and improve social justice and oppression (Kivunja & Kuyini, 2017). This allows people to speak without fear while eradicating inequalities in society. Similarly, Bertram and Christiansen (2014, p.27) contend that “The critical paradigm sees reality as shaped by social, political, cultural, economic and other dynamics.” Critical researchers aim to transform society to address discriminations, predominantly concerning ethnicity, gender, sexual orientation and disability. The critical paradigm in education research deals with the domination and unfairness in society that attempts to liberate persons as well as specific cultural groups to obtain influence and have autonomy from dissimilar political, social and other barriers that exist in society (Basnet, 2011; Bertram & Christiansen, 2014; Cohen et al., 2011). Therefore, the critical paradigm was suitable for this study which aimed to empower me as a TVET College lecturer to use blended learning and a flipped-classroom approach to enhance student learning.

To establish whether blended learning and a flipped-classroom approach enhanced student's learning of basic electronic tools and measuring equipment, I used an action research design. Carr and Kemmis (2003, as cited in Hagevik, Aydeniz & Rowell, 2012, p.675) define action research as “improvement of practice, understanding of practice and improvement of the situation in which the practice takes place”. Action research is a cyclical process which comprises four steps, specifically; planning, acting, observing and reflection which is required throughout all the steps for the researcher to make new conclusions (Koshy et al., 2011; Bertram & Christiansen, 2014). On the other hand, Koshy, Koshy and Waterman (2011) argue that steps can overlap and become superseded therefore preferring to describe action research as spiral in nature, which results in an increase in understanding and progress. As a result, Kemmis and McTaggart (2000, as cited in Koshy et al., 2011, p.5) describe action research as repetitive cycles of reflection containing the following steps: “planning a change, acting and observing the process and consequences of the change, reflecting on these processes and consequences and then re-planning, acting and observing, reflecting and then repeating the process as required”.

This study makes use of purposive and convenience sampling. As the researcher, I lecture to three different levels for the same subject, therefore I used purposive sampling to select the specific level of learners to be part of this research. I purposively selected 16 level two learners to be part of this study due to the gaps I found in learner knowledge at level three and four, thus choosing to address this at the starting level. However, four learners had to withdraw from the study, so the purposive sample that generated data comprised 12 Level 2 learners. I used convenience sampling to select the TVET College as I currently lecture at this TVET College. This was due to the convenience, availability and accessibility of participants of the study. According to Mertens (2004), this type of sampling is used when participants in the study are readily available.

Focus group discussion, questionnaires, survey and observation schedule were the primary data collection tools for this study. This study made use of thematic analysis to interpret and make sense of the data. Sparkes (2005) argues that the aim of thematic analysis is to critically probe narrative resources and then break it down into smaller themes of content which is then exposed to a descriptive process.

1.8 Overview of the dissertation

This dissertation on blended learning which made use of the flipped classroom approach in engineering in a TVET College is comprised of five chapters. Chapter One outlines the background, purpose and rationale of the study. Next, the research question guiding this study, the theoretical framework and research methodological approach are outlined. Chapter one concludes with an overview of the chapters of the dissertation.

Chapter Two presents the literature review, which outlined two key issues, namely, blended learning and the flipped classroom. The literature elaborated on how and why to use approaches, challenges faced when using these approaches, benefits to using these approaches and how these approaches could be used in vocational education. The chapter concludes by explaining the theoretical framework of Vaughn and Garrison's Community of Inquiry that was used to analyse the data.

Chapter 3 describes the research methodological approach used in this study. It describes the critical paradigm and action research design. It also substantiates the use of action research and describes the convenience and purposive sampling techniques used. Focus group discussions, lesson observations, survey and questionnaires as methods to collect data were also described. The chapter concludes by addressing issues of trustworthiness and ethics.

Chapter 4 presents the data and discusses the thematic analysis of data using an inductive approach in order to answer the research question that guided this study.

Chapter 5 concludes by summarising the findings in relation to the research question, draws conclusions and outlines recommendations for further research. The limitations of the study are also highlighted.

1.9 Conclusion

This chapter presented the background, purpose and rationale of the study. It also described the research question, the theoretical framework and methodological approach. To conclude, the chapter presented an overview of the dissertation. Chapter two presents the literature review and theoretical framework.

CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

In this chapter, I reviewed literature related to two key concepts, namely, blended learning and the flipped classroom approach. The chapter begins with a discussion of blended learning, highlighting the diverse definitions, followed by the significance of the blended learning approach as well as key models of blended learning. Secondly, the flipped classroom approach in vocational education is outlined and how it could be used in blended learning, key methods to the flipped classroom, learning effectiveness, the benefits as well as the challenges of the flipped classroom. The chapter concludes with a discussion of Community of Inquiry as the theoretical framework used in this study.

2.2 Defining 'Blended Learning'

In recent years, there has been increasing interest in 'blended learning'. According to Graham (2006), blended learning was identified as a top trend to develop in the knowledge delivery industry by the American Society for training and development. Similarly, Young (2002, p.33) argues that the union between face-to-face and online learning was "the single greatest unrecognized trend in higher education today." Although blended learning in recent years has become the catchword in higher education, there is still uncertainty about what this term means.

During the last decade there has been a noteworthy increase in the use of blended learning in higher education, including vocational education (Garrison & Vaughan, 2008; Graham, 2006; Bluic et al., 2012; Sahin, 2010; Yang, 2012). A review of literature highlights that there have been numerous studies on blended learning (Porter & Graham, 2016; Ruhalahti et al., 2017; Ramakrisnan et al., 2012; Boelens et al., 2017; Callen et al., 2015; Kaur, 2013; Graham, 2006; Graham, 2013; Graham & Allen, 2005; Graham et al., 2005), blended learning in vocational education (Sahin, 2010; Shen et al., 2011; Garrison & Kanuka, 2004; Kanuka & Rourke, 2008; Okaz, 2015; Bluic et al., 2012; Sharpe et al., 2006; Gibbs & Gosper, 2006), blended learning in action research (Kenney & Newcombe, 2011; Hughes, (2007); Rovai & Jordan, 2004;

Graham & Allen, (2005); Heinze, 2008) and blended learning as a creative strategy (Taylor & Newton, 2013; Carbonell et al., 2013; Baldwin-Evans, 2006; Lou et al., 2012).

Ruhalahiti et al. (2017) argue that blended learning as a concept is currently being used in environments that make use of online and face-to-face instruction (Graham, 2006; Wagner, 2006; Kennedy & Archambault 2012). Similarly, Singh and Reed (2001, p.1) contend that "a learning program where more than one delivery mode is being used with the objective of optimizing the learning outcome" can be defined as blended learning. On the other hand, Sahin (2010) asserts that blended learning must be simplified by an effective grouping of dissimilar learning methods, skills and distribution modalities to meet precise and distinct needs. In contrast, Sharples, Taylor and Vavoula argue that technology should not be the central concept that defines blended learning (2005, as cited in Ruhalahiti et al., 2017).

Kaur (2013) and Garrison and Kanuka (2004) define blended learning as a process that merges the best features of classroom contact and instruction with online experiences while delivering educational content in a personal way. Similarly, Singh (2003) explains that blended learning involves combining different delivery media to encourage motivating and meaningful learning. Likewise, Driscoll (2000, as cited in Okaz, 2015) argues that by mixing any instructional forms for an educational goal can be referred to as blending. According to Kosar (2016, p.737), the most predominant definition of blended learning centres on "the incorporation of online learning into face-to-face teaching and learning." Likewise, Boelans et al. (2017, p.2) explains blended learning as "a redefinition of instruction, in which technology is used to design instructional activities that were previously hard to organise, rather than substitution, in which technology is used for carrying out existing activities, without any functional change in teaching and learning."

However, Shen et al. (2011) assert that blended learning is a flexible approach to course design that maintains the blending of different moments and locations for learning, offers the services of fully online courses without the absolute loss of face-to-face contact. Similarly, Herrington, Herrington, and Mantei (2009, as cited in Ruhalahiti et al., 2017) recommend characteristics that must be merged into blended learning. In their view, the use of blended learning should be connected to situations and reliable contexts where learners can be portable. Ruhalahiti et al. (2017) contend that it must be probable to utilise mobile learning naturally, at any moment, and in both person and collaborative learning.

According to Klimova and Poulova (2011, as cited in Kosar, 2016), the following principles are required when implementing “blended learning: sustained assessment and evaluation; inventive use of technology; reconceptualization of the learning paradigm and the precise integration of face-to-face and online instructional components.” Alternatively, Rovai and Jordan (2004) argue that the effect of blended learning is potentially a more vigorous educational involvement than either traditional or fully online learning.

Blended learning is a wide-ranging concept which refers to learning and teaching with the help of technological devices. According to Lai, Lee Yeh and Ho (2005, as cited in Shen et al., 2011), blended learning is a system of technology-mediated learning and advances the learning outcomes through the alternation of actual program and internet courses. This discussion highlights the extensive selection of technologies and pedagogical methods allowing for various groupings that define blended learning. In this study, I adopt Graham's (2006, p.3) definition of 'blended learning systems' as learning systems that "combine face-to-face instruction with computer-mediated instruction".

2.3 Why adopt blend learning?

According to Shen et al. (2011), students in vocational schools when compared to their counterparts in universities, are inclined to have inferior levels of academic success. Correspondingly, Shen et al. (2011) argue that learners in vocational schools do not get immersed adequately in their schoolwork and worry little about their results. As a result, schooling in such a context, particularly teaching the syllabus of engineering, with the goal of learners earning certificates, is an immense challenge to most teaching staff. However, Psaromiligkos and Retalis (2003) contend that networked technology applied to vocational education holds substantial potential to progressing the interactivity between teacher and learner.

Learning and teaching in the twenty first century have been greatly influenced using the internet. Kosar (2016) argues that universities and higher education institutes recognise the need for change to the way they operate. Young (2002) highlights that not all learners study in the identical way; hence the conventional approach cannot be ideal for all learners.

López-Pérez et al. (2011) contends that blended-learning can be the way to confront the task of meeting the mandate for higher learning. With the growth of the Internet, university courses were established to be tutored online to provide better access to higher learning. However, Bersin and Associates (2003) affirm there has been criticism towards purely online courses since it does not support the benefits of face to face instruction. Shen et al. (2011) suggest that learners are prone to become dissatisfied and frustrated with completely online courses owing to a number of changes such as deficiency of synchronous communication and insufficient infrastructure. However, Linardopoulos (2010) argues that completely online courses can be compared to face to face teaching in terms of workload, academic rigor, knowledge and skills.

Garrison and Vaughan (2008, p. 153) affirm that “blended learning addresses the question of quality of learning and teaching. It is an opportunity to address pressing pedagogical concerns, while distinguishing and enhancing the reputation of institutions of higher education as innovative and quality learning institutions”. Blended learning provides more control for online learners and creates more accessibility and flexibility for classroom learners by integrating online and face-to-face learning. Obviously, the most general objective of blended learning is the opportunity of merging the best of both traditional and online learning (Young, 2002; Graham et al., 2005; Kumar, 2007). According to Jones and Lau (2009), higher learning institutions are moving from an entirely online delivery to a blended learning model because of the consequence of social interaction. Likewise, Graham (2006, p. 16) argues that a blend of online and face-to-face learning offers “effective learning experiences, increasing access and flexibility, or reducing the cost of learning”.

In terms of cost-effectiveness, Bliuc et al. (2012) contends that blended models have the reward of lowering expenditure for infrastructure and services as well as travelling expenses for learners who live off-campus. Moskal and Dziuban (2001) assert that teaching blended classes allows teachers to use new educational technology. Similarly, Singh and Reed (2001, p. 6) argue that “blending not only offers us the ability to be more efficient in delivering learning, but more effective”. Studies on blended learning have shown that it can be used to improve pedagogy, accelerate flexibility and access, enhance cost-effectiveness and improve performance (Graham et al., 2005; Osguthorpe & Graham, 2003).

According to DeLacey and Leonard (2002), learner interaction and satisfaction improved while also learning more with online content of blended learning courses. Besides, as a result of the Covid-19 pandemic around the world, the introduction of the notion and approach of blended learning was a spontaneous start for the submission of e-learning in customary university instruction. Huang and Zhou (2006) contends that not only do people recognise the value of blended learning in higher learning, but they also now appreciate that it offers a way to maintain instructional activities when tragedies or calamities inhibit standard instruction.

2.4 Significance of a Blended Learning Approach

According to Bonk (2004), increased access and flexibility is a key factor that has directed the growth of blended learning environments. Research has shown that many learning programs would not be able to take place if learners were not able to have most of their learning done through distance. Similarly, Graham (2006) argues that convenience and learner flexibility is much more appropriate for older learners who have extra commitments while still trying to improve their education. Therefore, blended learning offers a convenience for learners who also do not want to lose the social interaction experienced in face to face teaching. Similarly, López-Pérez et al. (2011, p.819) affirms the significance of different teaching and learning methods which “a) enables students to acquire a deeper understanding of the subject; b) promotes positive perceptions of the teaching received; c) clarifies goals and rules; and d) provides students with a higher level of independence in the learning process”. Likewise, Spanjers (2015, as cited in Boelens et al., 2017) suggests that the merging of online and face to face actions enhance learning opportunities by stimulating and supporting learning.

Callan, Johnston and Poulsen (2015) assert that organisations in Australia responsible for vocational education are using blended learning that makes use of e-learning to improve its outcomes. Mobile technologies have been one of the vital facilitators of change in blended learning. This is due to the more flexible, innovative and flexible training that can result from blended learning. Similarly, they found that e-learning used with blended learning could also improve communication between teachers and students, social relationships, greater cost-saving for employers and increased levels of student satisfaction. On the other hand, teacher attitude when using these online technologies and related strategies was acknowledged as a main obstacle to support e-learning delivery. In addition, Hunt (2015) and Tomas et al. (2015,

as cited in Ruhalahti et al., 2017) affirm that blended and mobile teaching and learning approaches, drawing on inquiry-based learning, have become more frequent and are enticing an increasing level of curiosity from researchers.

According to Kosar (2016, p.737) blended learning can supplement the outcomes required by education currently which are. “learning and innovation skills such as critical thinking and collaboration, information, media and technology skills, and life and career skills encapsulating self-direction, adaptability, responsibility, social skills and leadership”, Likewise, López-Pérez et al. (2011) contend that blended learning can expand, improve and transform face to face learning due to its paradigm shift from teaching to learning. According to Boelens et al. (2017), the advanced progression of information and communication technology in education has seen the use of blended learning being used more often. In addition, Kosar (2016) claims that these demands cannot be satisfied by compelling learning and education to specified spaces and limited classroom hours. Bonk and Graham (2012) affirm how blended learning changes the role of learners in the process by changing from passive receivers of knowledge to active knowledge constructors.

Another reason for implementing blended learning is also the cost effectiveness of the programs. Graham (2006) argues that cost effectiveness is the third major goal in corporate and higher education institutions when implementing blended learning. With blended learning there is a greater opportunity to reach a greater number of students, who are dispersed globally. Higher education facilities could save on cost for reduced physical infrastructure and help improve planning efficiencies. Similarly, Kosar (2016, p.737) explains four strategies implemented into blended learning which can be useful to learners, namely, “web-based delivery, which promotes independence and self-reliance in learning; face-to-face processing, in which human interaction is necessary to build a deeper understanding; creation of deliverables, expecting learners to create products; and collaborative extension of learning – groups meet once a month to share and build upon”. According to Barnum and Paarmann (2002), these strategies help reinforce learner autonomy, promote learners to produce outputs, and stimulate cooperation amongst learners. In addition, Kosar (2016) explains how online environments can enable learner-centeredness to act as a vehicle for increasing learning in other fields. Likewise, Garrison and Kanuka (2004) argue that the integration of technology and face to face learning can have meaningful outcomes since it can reinforce communicative and interactive learning.

2.5 Different Perspectives of Blended Learning

As a result of the multitude of different definitions, Kaur (2013) argues that definitions in blended learning need to be looked at from different perspectives which he identifies as the Pragmatic Perspective, the Educational Perspective and the Holistic Perspective. Furthermore, Kaur (2013) contends that the Pragmatic perspective refers to courses taught in the classroom and through distance education, which use a combination of different pedagogic strategies. He adds that the Educational perspective describes courses that incorporate online and traditional face-to-face class activities in a scheduled manner of pedagogical value; and where a percentage of face-to-face time is substituted by online activity. For Kaur (2013), the Holistic Perspective refers to the delivery of instruction using numerous media.

However, a key question when discussing blended learning and other dialects is: What is being blended? According to Graham et al. (2005), blended learning involves:

1. Combining instructional methods (Driscoll, 2002; House, 2002 & Rossett, 2002)
2. Combining instructional modalities (Bersin & Associates, 2004; Orey, 2002; Singh & Reed, 2001 & Thomson, 2002)
3. Combining face-to-face and online instruction (Reay, 2001 & Young, 2002)

It is evident that points one and two above are closely connected. Correspondingly, Kaur (2013) defines blended learning as the effective combination of styles of learning, models of teaching and different modes of delivery, which are implemented in an interactively meaningful learning environment. According, to Kosar (2016), combining different instructional modalities, allows blended learning to take place.

In addition, Graham (2006) affirms that it would be difficult to discover a learning system that did not include several delivery media and instructional approaches. Therefore, using either of the first two points to define blended learning will not get the crux of why blended learning excites so many people and what blended learning entails. Figure1 below describes how one traditional face-to-face learning environment which has been used to compare new technology distributed classrooms has grown exponentially as a result of advances in technology.

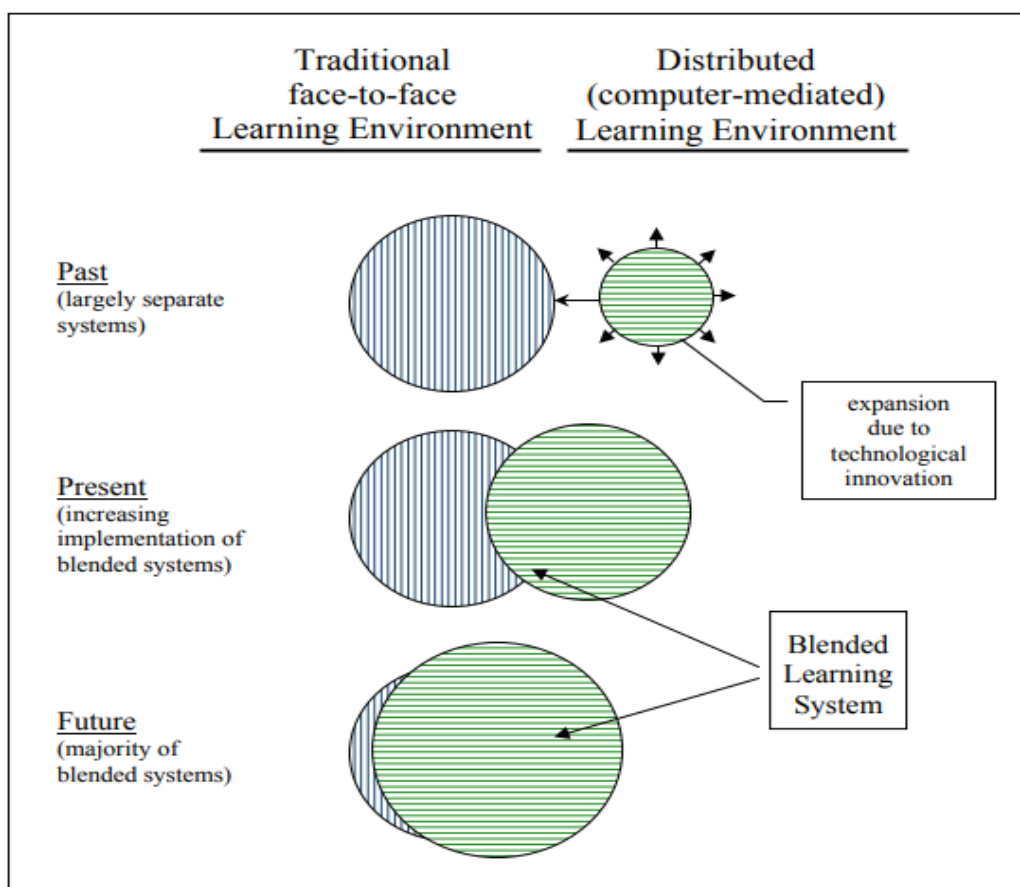


Figure 2.1 Blended learning systems (Graham, 2006, p.28)

Figure 2.1 is used to show how blended learning systems have evolved over time and will continue to do so. The past in the diagram shows how face to face and computer aided learning were seen as two different aspects, the present shows how technological advances the two merge and lastly the future shows how blended learning systems will dominate face to face learning systems.

In the next sub-section, I outline levels of blended learning and the similarities and differences in higher education models.

2.6 Levels of Blending

There are various blended learning practices being used that share some strategic similarities, which will be discussed in this section. A noticeable characteristic when looking at the different models of blended learning is that they can occur at different organisational levels. Graham

(2006) differentiates the following levels of blended learning: Program, Course, Activity and Institutional levels. Similarly, Ross and Gage (2006) and Wright et al. (2006) concur that blended learning occurs at these different levels.

The learner or teacher across all four of these blends will determine the nature of these blends. According to Graham (2006), program and institutional levels are most often left to the preference of the learner, while teachers will more likely prescribe the blend at activity and course levels.

2.6.1 Activity Level Blending

To blend at the activity level, learning must consist of computer-mediated and face-to-face elements. According to Oliver and Trigwell (2005), activity level blending can make use of technological tools which help make this type of strategy more authentic. However, Jung and Suzuki (2006) argue that this type of blending allows experts to be brought into classrooms from a distance to simulate computer-mediated and face-to-face teaching.

2.6.2 Course Level Blending

This type of blending is regarded as the most common way to blend. According to Graham (2006), course level blend consists of a distinct blend of computer-mediated and face-to-face actions used as part of the course. Huang and Zhou (2005, as cited in Graham, 2006) contend that these blended activities support learners with computer-mediated and face-to-face approaches which overlap in time. However, Jagannathan (2006) argues that sometimes the approach might isolate the time frame, so they are sequenced chronologically but not overlapping.

2.6.3 Program Level Blending

Ross and Gage (2006) maintain that blends at higher education are dependant of the degree program level. Program level blending is often one of two models. The first is where learners can choose a mix between online and face-to-face courses or the combination between the two is predetermined by the program. Similarly, Reynolds and Greiner (2006) and Wright et al.

(2006) concur that education courses that blend computer-mediated and face-to-face understandings can be regarded as program level. Salmon and Lawless (2005, as cited in Graham, 2006) contend that a certain program affords a student the choice for completing the course with participation in extended on-campus classes, face-to-face with online tutoring or completely online; and that there is no prescribed amount for each of the blend.

2.6.4. Institutional Level Blending

According to Graham (2006), institutional level blending occurs when organisations have made an administrative commitment to blending computer-mediated and face-to-face instruction. Many models of blended learning in higher education settings have been created at an institutional level. According to Dziuban et al. (2004), the Medium enrollment course design which created a reduction of face-to-face time is another example of institutional blending by the University of Central Florida. Similarly, Brigham Young University in Idaho enforcing mandatory online learning as part of course work to graduate is another example.

However, Dziuban et al. (2004) argue that not all institutions that make use of institutional blending have blended learning in mind. There must be an intensive effort made to ensure learners are given a fair chance to use both ends of this learning band by the organisation for it to be referred to as blended learning. To have a distance learning program that is separated from the day-to-day organisation operations is considered insufficient for institutional blending. Furthermore, Porter and Graham (2016, p.750) outline the following key points that must be considered when using this blend: "Strategy do not includes issues regarding the overall design of blended learning, Structure encompasses issues relating to the technological, pedagogical and administrative framework facilitating the blended learning environment and Support involves issues relating to how an institution facilitates faculty implementation and maintenance of its blended learning design."

2.7 Four Key Models of Blended Learning

Christensen et al. (2013) describe four models used in many blended learning courses: Enriched Virtual, A La Carte, Flex and Rotational models. The Rotational model is further divided into

four sub-models; these are Individual Rotation, Station Rotation, Lab Rotation and Flipped Classroom.

2.7.1 Enriched Virtual Model

This model is described as a course that allows learners to have face to face learning sessions with the instructor and then completing the rest of the work off-site. Online learning is the main support structure for learners when they are not in school. The instructor is generally the same person teaching both online and face to face. With this model, learners rarely meet face to face with the instructor every day. The difference between this module and a fully online course is that the face-to-face sessions are mandatory. Most of the learning is done online and there is very limited face to face session. The face-to-face lessons are most often used to engage in more inclusive assessments of learning or it can be used as an introductory lesson for expectations and material. More than often at the end of the enriched virtual model course, learners present what they have understood to other learners in the course. By engaging in this model, learners are taught to develop listening and speaking skills in a mainly online learning environment.

2.7.2 A La Carte Model

This model caters for students who wish to complete a course entirely online which will also go with other understandings from a learning school. The instructor in this case will be an online teacher. The course can be completed at a brick-and-mortar site (traditional public-school model of curriculum and instruction) or online off-site. It is also noted that this model is different from full time online instruction as it does offer the experience of the whole school participation.

2.7.3 Flex Model

In this model, online learning caters for most of the participant learning done in the particular course. It is noted that some learning activities might occur that does not use the online channel, but these are minimal. Learners have the freedom to adapt and modify learning schedules and modalities to suit their individual needs. The instructor for this model operates on-site and

learners work from a brick-and-mortar site. There are exceptions to working on-site, these normally occur for assignments and specific sets of homework. Instructors for these models offer face to face instruction but this is done on an as-needed basis. This is usually done through group projects, individual tuition and small group instruction. It is also noted that in unique cases, there can be extensive face to face provision. This is also dependent on staffing qualifications and combinations of programs.

2.7.4 Rotational Model

This model involves learners working at the instructor's discretion or a fixed schedule when using learning modalities. One of the learning modalities used must be online in nature while others could make use of individual tutoring, paper assignments, group projects and full class instruction. Learners work mostly on brick-and-mortar sites except for homework. The Rotational model can be further broken down into four models: station, lab, individual and flipped classroom (Horn & Staker, 2014):

- **Individual Rotation** – courses in this model it allows each learner to have a personalised schedule and the learner is not required to attend each venue or modality of learning. Schedules for each learner are set either by the instructor or an algorithm.
- **Station Rotation** - learners doing a course in this model are kept in a teaching space or group of teaching spaces while experiencing the rotational model. What makes station rotation different from individual rotation, learners must interchange through all venues and not only those on their personalised schedules.
- **Lab Rotation** – this model requires learners to move to a computer centre venue for the online learning modality.
- **Flipped Classroom** – this model allows learners to do a course, which makes use of online learning replacing homework off-site while getting teacher-guided practice and face-to-face tuition on a brick-and-mortar site. Flipped classroom key distribution of instruction and content is online. This is a key description of the flipped classroom and what separates it from learners who use online channels just to complete homework (Horn & Staker, 2014).

Peterson (2016) argues that blended learning definitions can end up being too diverse when compared to the description of the flipped classroom which is somewhat more controlled. As a result, this research will focus on blended learning that makes use of the rotational model using the flipped classroom approach.

2.8 Flipped Classroom Approach

In 2007, two teachers Jonathan Bergmann and Aaron Sams, brought attention to this approach by broadcasting their live lessons on an online platform for learners who might have missed lessons in their classroom (Bergmann & Sams, 2014). According to Arnold-Garza (2014), the flipped classroom is also known as the inverted classroom or in simple terms the flip. Turan and Akdag-Cimen (2019) suggest that the flipped classroom approach can be used in different fields such as, engineering fields, teacher education, mathematics, health education and statistics to name a few. This approach has been argued to better prepare learners before a lesson can start thus improving the quality of learning taking place during the face-to-face lesson (Bristol, 2014; Formica et al., 2010).

The flipped classroom was developed through the investigation of using technology and dynamic learning techniques from a blended learning platform. Tucker (2012) and Strayer (2012) assert that the flipped classroom method can be regarded as a special category of blended learning which they acknowledge as the most prevalent and dynamic approach that can be used. With the rapid changes and improvements to technology while compared to the decline in learning infrastructure, poor resources and larger learner numbers, the emergence of the flipped classroom as a new strategy was highly required. Using the flipped classroom model in recent years has gained popularity. According to Watters (2012, cited in Mok, 2014), flipped classroom pedagogy has been one of the leading trends for educational technology. Flipping the classroom in theory appears attainable, since it allows for lectures to be done outside of classroom time. Correspondingly, using the flipped classroom method could be beneficial in vocational subjects where the lecture is primarily used to provide instruction. Abeysekera and Dawson (2015) affirm when using the flipped classroom approach, there can be greater emphasis on pre/post class work and active teaching in classroom tasks. As a result, learners and teachers can focus class time on skill development, active learning of practical concepts and problem-solving techniques. However, even with vast amounts of research stating this

benefit, numerous vocational education institutes still employ the long-established homework-after-class and lecture-in-class technique. In order to improve learner's commitment and improve their learning experience with this module, an action research model coupled with the flipped classroom model was used.

Mok (2014) argues that teachers normally deliver lectures during classroom time and give students homework to complete after the lecture in a teacher-centered classroom. However, in flipped or inverted classes this is not the case, since these practices are done in the opposite. Likewise, Lage et al. (2000, p.32) contend that "Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa". Likewise, Ogden, Pyzdrowski and Shambaugh (2014, p.49) assert that the flipped classroom approach to teaching is "a pedagogical design that replaces what typically takes place during a face-to-face lecture (passive transfer of knowledge) with engaging activities and assigns the lecture as homework for students to complete autonomously outside of class".

Bishop and Verleger (2013) argue that the flipped classroom must be a learner-centered technique that contains two parts, a specific teaching model based directly on a computer after lessons, and collaborative learning activities during lessons. Similarly, Milman (2012) argues that this approach focuses on improving the efficiency of classroom learning by making use of various teaching and learning styles such as group work, discussions, videos and podcasts. The lectures are normally done in advance before class, normally in the form of online content while class time is more focused on working with students and strategies that involve more collaboration and interaction. Likewise, Mok (2014) argues that unidirectional lectures should not be done in class time and should be replaced with dynamic learning activities.

According to Mull (2012) and Kim et al. (2014), the flipped classroom approach allows learners to view course work such as presentations, online videos, learning management systems while taking notes and preparing questions about their misunderstandings before their actual face-to-face lesson takes place. Similarly, Formica et al. (2010) argue that the flipped classroom approach allows the face-to-face lesson to encourage supporting activities like group work, discussion, problem-solving, making interpretations and finding solutions together. For Bergmann et al. (2011), a key idea about the flipped classroom approach is that the learning accountability is shifted from the educator to the learner.

However, Hamdan et al. (2013) maintain that the flipped classroom cannot be a defined model, since it is dependent on the way teachers select different equipment to help compensate the difficulties facing learners. According to Bull, Fester and Kjellerstrom (2012), teachers have used numerous methods to use the flipped classroom since objectives with learning context govern what structures are important. Flipped Learning Network-FLN (2014) argues as a result of teachers using numerous methods in the flipped classroom to suit their specific requirements, the flipped classroom concept changed to the flipped classroom approach. This allowed the new approach the ability to be used with various learning methods and styles.

2.9 Key Methods to Flip the Classroom

There are many ways to flip a classroom and there is no ‘one approach fits all’ model that can be used. When looking at the different models of a flipped classroom, some could be categorised as unproductive as it does not allow for instruction and training to be used to its full potential, however, there are other models which are deemed more necessary, successful and effective. However, Brown (2016) argues in all flipped classrooms, the teacher’s role is more to guide the learning process, help learners work through concepts as they problem solve and facilitate dialogue.

2.9.1 Traditional Flip

In this approach, Bergmann and Sams (2012) argue that learners watch lectures in the form of videos as homework. The intention behind this is to give learners information and knowledge before their lesson the next day. Learners may have to complete the tasks required when watching video lectures. During the class lesson, the teacher then discusses problems and questions learners might have from videos, then start the active lesson for that day. Likewise, Ozdamli and Asiksoy (2016) contend that teachers begin lessons with question-and-answer sessions from videos watched at home, time is then spent on supporting active learning in the classroom. Work that is done during these lessons would normally have been assigned as homework. Learners must take responsibility for their learning activities which may include classwork and homework needed to be done in a set timeframe. According to Johnson et al. (2015), the traditional flip is the most used model of the flipped classroom approach as it allows learners to learn, network and participate with their classmates.

2.9.2 In-class flips

Bergmann and Sams (2012) suggest there are similar features between the traditional and in-class flip, however, the key difference is learners do not have to finish learning videos and activities after school. The main idea behind the in-class flip is all learning activities are to be completed in the classroom. According to Brown (2016, p.13), the venue will have different stations "where groups of student work independently, collaboratively, or a combination of the two, to complete the project-based, critical thinking activities." These stations should all be doing different tasks, to cater for learners who have finished a task and want to try another. This allows the learners to work at their pace while waiting for the rest of their original group to finish the task. The teacher in the in-class flip can move between stations to guide a particular group with their misunderstandings and problems. Learners who feel they may require more time with the videos can choose to go back to that station when needed, as the flexibility of the flipped approach caters for that. The key role of the teacher with the in-class model is to choose, control and contain all compulsory and important learning activities and work within the limits of a school day. This model also caters for the problem of learners not having access to online facilities at home.

2.9.3 Mastery flip

According to Bergmann and Sams (2012, p.107), there are three essential components to this flip: "Students work either in small groups or individually at an appropriate pace. The teacher assesses students and gauges student understanding. Students demonstrate mastery of objectives on summative assessments. For students who do not master a given objective, remediation is provided." Brown (2016) argues that in the master flip, learners must be made aware of the lectures, learning tasks and intentions and assessments right from the start of the course. As the course progresses, learners can choose the tasks they wish to complete at their own pace and time. These tasks that are completed should allow learners to demonstrate their understanding when completing the designed summative assessments. Brown (2016) argues that learners should only move to the next learning task if they have met the criteria for the assessment, otherwise extra learning tasks may be needed to ensure the learner has grasped the concepts. To cater for the different pace and needs of learners which can be seen as a problem

when using this flip, teachers could allow the learner to work through the learning material at their own pace, but specific learning tasks and assignments will have due dates.

2.10 Learning Effectiveness of Flipped Classrooms

According to Lin and Chen (2016), the measurement of learning effectiveness has two critical factors which are learning effectiveness and learning satisfaction. However, they explain that numerous other factors could also influence these two critical factors. Lin and Chen (2016) describe these six possible factors as interpersonal relationships, learning outcomes, curriculum, learning environment, teachers and administration.

2.10.1 Learning Satisfaction

Lin and Chen (2006) argue that learning satisfaction is a key component when measuring learning outcomes in a flipped classroom. Furthermore, they argue that other factors such as learning environment, teachers, curriculum and learners' issues also contribute towards learning satisfaction either in positive or negative aspect. There are three components to look at to better understand learning satisfaction in a flipped classroom. Lin and Chen (2006) explain learning attitude as a fairly steady psychological bias that a learner has towards learning status and learning. It is regulated by; 1) observation of the attention given, sentiments shown, and intellectual level that the learner shows while learning; 2) learning motivation is referred to the motivating force that pushes an individual to learn. Learning motivation is directly linked to how positive, how happy and how active the learner is during learning; and 3) interest in learning refers to an optimistic sensitive inclination that the learner has towards the learning outcome, and where the learner comprehends and is enthusiastically looking for contact with it. These are the components that propel learners to actively learn.

2.10.2 Learning Effectiveness

There are many definitions of learning effectiveness when using a flipped approach. Chen et al. (2005) describes it as a way of looking at the scholar's education progress by considering developmental and cumulative assessment results. Similarly, Chen Hsieh et al. (2017) explains it as the gauge used to measure a scholar's learning effectiveness which is also used to determine teaching quality. Alternatively, Snowden (2012) found that there is no noteworthy

variation between learner achievement, perception and effectiveness when using the flipped learning and traditional teaching methods.

Hao (2016) contends that learner effectiveness in a flipped classroom is reliant on how well learners can use online resources and the accessibility to the online platform. Likewise, Zhai et al. (2017) assert that face-to-face interaction, learning material on online platforms and the interface with the online platforms are three key pillars in flipped classrooms that contribute towards learner's effectiveness and quality. Zhai et al. (2017, p.201) affirm that “While in the settings of flipped classrooms the dimensions of interactive platforms and online courses have a close relationship with information technology, additionally flipped settings emphasise effective interaction among instructors and peers in physical classes for promoting teaching quality.”

However, Lin and Chen (2006, p.234) suggest that these three key components should be considered when defining learning effectiveness “1) school grades; 2) the number of professional certificates; and 3) external examinations.” As a result of these three variables and all the possible implications they hold, Lin and Chen (2006, p. 235) affirms learning effectiveness as “an indicator for measuring learning outcomes, and is one of the most important criteria used for assessing teaching quality.”

2.11 Flipped Classroom in the Context of Bloom’s Taxonomy

According to Bergmann and Sams (2014), the outcomes of learning and teaching can be achieved using Bloom's taxonomy. Ogden et al. (2014, p.110) break down the six levels that make up Bloom's taxonomy as “remembering, understating, applying, analysing, evaluating and creating”.

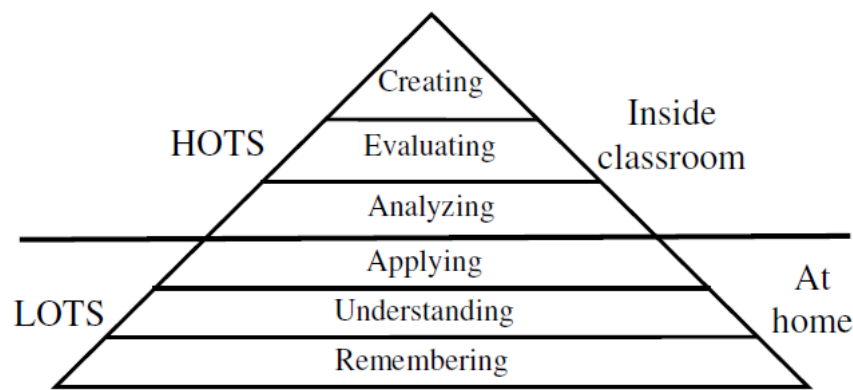


Figure 2.2: HOTS and LOTS in a flipped approach (Ogden et al., 2014, p.110)

Bergmann and Sams (2014) argue in Bloom's taxonomy creating is regarded as the highest level while remembering is its lowest level for the cognitive domain. However, the total six levels are separated into two groups which define them as higher-order thinking skills (HOTS) and lower-order thinking skills (LOTS). Koch (2016) argues that LOTS are found to take place in classrooms that are teacher-centred, and learners are prepped to study facts and not focus on meaningful concepts. As a result, teacher-centred classrooms do not exceed the bottom three levels of skills achieved. On the other hand, the flipped approach uses the HOTS for activities in the classroom and LOTS for tasks outside the classroom.

Bloom's taxonomy is reversed in the flipped classroom since learners take responsibility for their learning. Similarly, Ogden et al. (2014, p.110) confirm that "Students have to practice remembering, understating and applying at home through watching video, visiting course-related websites, listening to audios or at least reading the lesson. In class, teachers help students analysing, evaluating and creating the knowledge been assigned." In flipped classrooms as a result of using and engaging in higher-order skills in class, you also enable and bring in to use the lower-level skills too. According to Conklin (2012), a bonus of using HOTS can result in learners gaining valuable skills and training required for real-world relevance outside the classroom? Additionally, Brookhart (2010) asserts that HOTS learners improve because they are having more fun from understanding content when compared to just memorising work. Furthermore, this tends to cause greater motivation leading to better achievement.

2.12 Benefit of a flipped classroom

There are numerous benefits of using flipped classrooms. These benefits include: greater dynamic learning occasions for learners, class time is used more efficiently, greater one-on-one collaboration between learner and teacher, greater learner responsibility for learning, being able to use numerous learning styles (Bergmann & Sams, 2013; Gallagher, 2009; Overmyer, 2012; Cole & Kritzer, 2009; Gannod et al., 2008). Likewise, there can be increased learner engagement, learner's intellectual load lessening and academic attainment being achieved as a result of the flipped classroom (Turan & Goktas, 2016; Chen Hsieh et al., 2017). On the other hand, O'Flaherty and Phillips (2015) argue that the flipped approach affirmed tremendous improvement in academic results but could be due to the improvement in attendance.

According to Radio M (2013) and Flipped Learning Network (2012), the use of flipped classrooms has resulted in enhanced pass rates, improved learner attitude and flexibility and reduced stress by teachers. Similarly, Mok (2014, p.7) contends that learners who “engage in open-ended exploration first outperformed those who used traditional textbook materials first, and implies that video lectures and textbooks should come after exploration, and not before.” There have been numerous studies examining motivation, engagement, perception and active learning when using the flipped classroom model (Long, Logan & Waugh, 2014; Mason et al., 2013; Johnson & Renner, 2012; Snowden, 2012).

Ramírez et al. (2014) and Mason et al. (2013) identify three key advantages that are instrumental to the success and implementation of the flipped classroom: 1: the flipped classroom enables a teacher to complete and cover more syllabus; 2: learners that have used the flipped classroom approach, achieve better results when completing quizzes and open-ended questions showing improvement in cognitive thinking; and 3: initially learners battle with the new learning style, however, they are found to adapt quickly, improving their independence and learner accountability. Ramírez and Macías (2015, p. 12) suggest that this is the result of learners being “born in the technology era, and they are highly motivated when it comes to things they can see, do, and understand.”

O'Flaherty and Phillips (2015) assert that another benefit of the flipped approach is its cost-effectiveness when delivering a learner-centered curriculum while dealing with larger learner numbers and cuts in government funding in higher education. As a result, student learning

moves to being active and ground-breaking since the advancement of this cost-effective approach also challenges “the pedagogical stance of traditional didactic teaching seen for decades within universities” (O’Flaherty and Phillips, 2015, p. 86).

2.12.1 Dynamic Learning

According to Bergmann and Sams (2012), by making use of a flipped classroom, a learner should not be taking notes for two hours during teaching in a classroom; instead the time should be utilised for problem solving and discussion with learners. Therefore, Osman et al. (2014) believe that by flipping the classroom, the time taken for lecturing in a classroom is reduced and can be used on other dynamic strategies. Consequently, these teaching hours gained as a result can be used on active teaching and learning activities. Nguyen (2012) contends that this approach allows learners to express their understanding and knowledge in the classroom with guidance from a teacher as well as the improvement of active learning activities. Likewise, Roehl et al. (2013) affirm the benefits of using flipped classroom include learners asking better quality questions and thinking more deeply about the content as the module progresses.

According to Little (2015), the advantage of using this instructive approach is the time being redistributed for dynamic, higher-order and experiential thinking to be used during class time. Likewise, Bergmann and Sams (2013) argue that the main objective of this model is to improve learner’s dynamic learning, scaffolding and collaboration during the learning progression with an improved distribution of teaching time. As a result, the flipped classroom can be described as a dynamic, learner-centred approach that was created to improve the quality of learning taking place in the classroom. Likewise, Bergmann and Sams (2012, as cited in Roehl et al., 2013) assert learners can view the lecture content before a class; more hours can be dedicated to dynamic learning which encourages deeper understanding of the subject content.

The uploading of syllabus with online quizzes can add an interactive feel which can strengthen ideas and concepts before a lesson can begin. Arnold-Garza (2014) argues that this leads to active learning taking place which increases profound engagement with learners without the extra resources. Gerstein (2011) uses the figure below to reinforce how dynamic/active learning takes place in a flipped classroom.

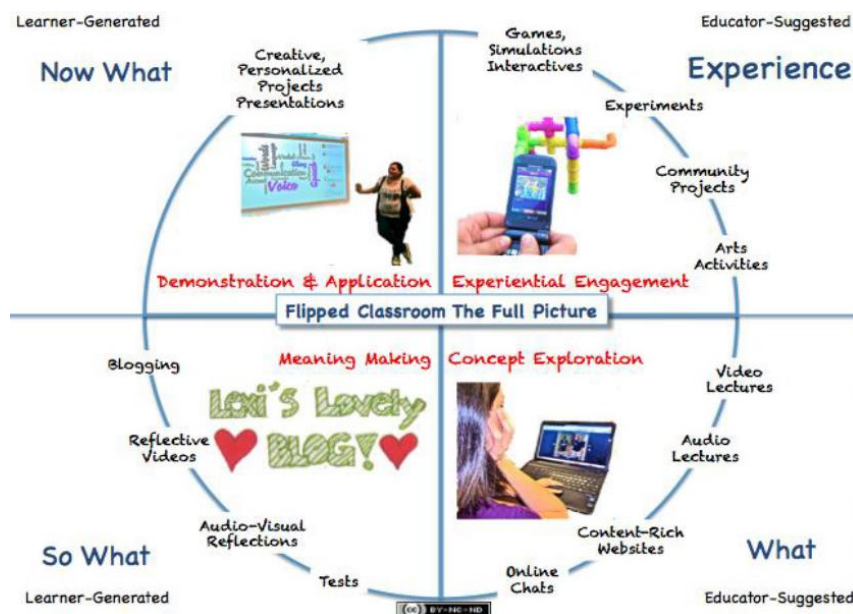


Figure 2.3 Dynamic learning by Gerstein (2011, p.16)

2.12.2 Learner Perception

According to the Flipped Learning Network (2014), learners claimed that this mode of learning was an excellent way of learning. Likewise, Bishop and Verleger (2013, p.10) affirm that learner perceptions "tended to be positive, but there were invariably a few students who strongly disliked the change". Ferreri and O'Connor (2013) argue that the perception of learners overall was positive with regards to the flipped approach. However, Snowden's (2012) findings show no noteworthy variation between learner achievement and perception when using the flipped learning and traditional teaching methods. According to Mason et al. (2013) learners enjoyed the use of online platforms that the flip approach introduced. However, numerous learners preferred the face-to-face component and the dynamic learning it offers as it suited their learning (Mason et al. 2013b; Enfield 2013; Phillips and Trainor 2014). Long, Logan and Waugh, (2014) claim that student perceptions favour the video lecture, followed by movie lecture and webinar when using pre-class learning material. Therefore, learner perceptions are an important predictor of the flipped classroom setting.

2.12.3 Learner Responsibility

The flipped classroom creates an environment to control one's learning interests, pace and approach. Gallagher (2009) argues that the increase in learner responsibility and reduced teacher responsibility in a flipped classroom is another key benefit, since learners have ultimate responsibility and a more dynamic role in their learning. Flipped classes allow learners to better understand their learning processes when compared to the traditional setting. O'Flaherty and Phillips (2015) argue that the flipped classroom approach nurtures learner ownership in learning by finishing preparatory work online and being interactive during face-to-face lessons. Furthermore, O'Flaherty and Phillips (2015, p.85-86) outline the following advantages: "it allows students to learn at their own pace and that they may have the flexibility of when they engage with electronic resources, it frees up actual class time for robust discussion and associated problem-solving activities related to the aforementioned resources, and that these discussions could be initiated by the students, not the staff member."

This gives rise to asynchronous learning where learning of identical material can be accomplished at different locations and time. Arnold-Garza (2014) affirm asynchronous learning caters for the needs of different learners, those who need more time to analyse, manage or pause and for learners who grasp knowledge faster and are ready to move onto the next concept. According to Roehl et al. (2013), by allowing the learner to use their learning style to interact with the content in a flipped classroom, the strategy is found to be more successful.

However, Slocum and Beard (2005) maintain that by developing computer-aided instruction modules, learners are better directed to suit their skill level using unique learning paths from limited class time. This also enables learners to be comfortable and converse about a subject at their specific level while steadily reinforcing their knowledge with what they already understand. This type of collaboration enables learners to reduce the knowledge gaps or misunderstanding they might have.

Yilmaz (2017) explains that learner responsibility is essential if flipped classrooms are to be successful, since participants are responsible for developing their technology self-competence and direct their leaning. As a result, of the responsibility put on learners in this approach, O'Flaherty and Phillips (2015) argue there is the potential to prepare learners in learning and working environments with the skills to address labour shortages. In contrast, Strayer (2012)

argues that extra responsibility may not cater to the needs of first-year learners. He maintains that they are still learning their specialisation and may not have genuine interest and maturity to adapt and commit to the program.

According to Dabbagh and Kitsantas (2012), personalised learning is recognised as a pedagogical approach for fine-tuning learner's pace and studying style. Similarly, McLoughlin and Lee (2010) argue that personalised learning enables learners to empower themselves by choosing techniques best suited to efficiently handle their learning. Likewise, Chen et al. (2005) argue that the connection between personalised learning as promoted in flipped classes and learner satisfaction has been widely documented in past research. Correspondingly, Zhai et al. (2017, p.200) explain how “personalised e-learning facilities can enhance online learning effectiveness in terms of examination, satisfaction, and self-efficacy, since personalised settings offer learners an environment in which their ideas can be explored, compared and critiqued”.

2.12.4 Collaboration

Bergmann and Sams (2014) argue that a flipped classroom could have positive effects and a profound impact on teachers and learners lives. According to Ogden et al. (2014), collaboration is a key a component that allows for an effective flipped environment, even if the lesson may seem unsystematic, loud or even chaotic, however, this collaboration benefits the learners understanding and learning processes. Arnold-Garza (2014) argue that allowing learners to participate with learning material, concepts and other learners in the classroom, a spinoff is created with increased one on one interaction between learner and teacher. Correspondingly, Anderson et al. (2001) contend that during face to face time, there is a focus on collaborative processes which tends to use applications such as analysing, development and creating solutions to explain concepts and contextualise information. Likewise, Prensky argues that scholars can experience more learner-centred strategies which can lead to peer-to-peer collaboration and teacher to learner mentoring (2010, as cited in Roehl et al., 2013). Individual or group work exercises in small numbers managed by learners’ enables teachers to focus on problems and questions as they arise in class, while checking in on other learners in the classroom (Lage et al., 2000).

Similarly, Moore et al. (2014) argue that learner and teacher engagement is significantly increased, resulting in greater one on one sessions to support improved cognitive demand; classwork and homework completion improved, and most significantly learners who did not do the online task still had the opportunity to work with friends in class to catch up without being severely disadvantaged. However, Overmyer (2012, as cited in Arnold- Garza, 2014, p.10) argues that collaboration can take place as a class explaining, "students may reflect on the lecture material through questions and discussion with their teacher, by working with their peers to solve problems based on lecture content, by demonstrating or arguing their solutions to classmates and the teacher, by checking their understandings through in-class experimentation and lab work, and by peer tutoring or creation of learning objects".

Likewise, Enfield (2013) argues that the detailed rationale of the flipped classroom recognises the support factor of classroom application, explaining how learners find complexity with homework as a result of unversed material and the better opportunities face to face lesson can provide. Furthermore, the efficiency of time saved allows for learners to gain profound meanings of concepts. However, Pierce and Fox (2012, p.4), argue that "quality, not necessarily the quantity, of student-teacher interaction, is a compelling force in improving student performance" and this is catered for during dynamic teaching in flipped classrooms. On the other hand, this advantage may not apply to large class numbers unless teaching helpers are provided (Lage, et al., 2000).

According to Chen Hsieh et al. (2017), this approach allows information to be given to learners when they are not attending school with the aid of online platforms and videos while allowing active practices to take place under the guidance of the teacher in the classroom. This creates an interactive environment where learner participation is encouraged. Learning from online platforms happens according to individuals own pace and needs as learners now have options to replay, pause and rewind videos. As a result, the flipped approach advances active and collaborative environments that cater for a deeper understanding of concepts during flexible learning times and collaboration (Franc1, 2014; Chen Hsieh, Wu, & Marek, 2017; Amirousefi, 2017).

2.13 Challenges of a Flipped Classroom

Research has also identified challenges of implementing flipped classrooms. According to Blair et al. (2016), challenges have been recognised during the implementation phase of flipped classrooms. Similarly, Enfield (2013) explains this as the phase that requires a substantial quantity of time to get online information ready while ensuring it meets the required criteria. Likewise, McGivney (1993, as cited in Callen et al., 2015, p.297) explains the challenges to learning which include “situational factors (e.g. the ease of use of a new technology, lack of money to purchase equipment, lack of time); institutional practices and procedures (e.g. rules about evidence, assessment practices); and dispositional issues (e.g. attitudes of learners, teachers and employers).”

Blair et al. (2016) pointed out the issue of staff not buying in and being uncomfortable with this new learning approach. Similarly, Kliger and Pfeiffer (2011) highlight the challenge of staff not being devoted and enthusiastic to learning and using this new technology and applying this methodology. As a result, Al-Ani (2013) explains the importance of teachers adapting to this new teaching style as research has shown it can affect learners’ achievement and engagement. There are numerous research studies that outline the problems teachers face with this approach (Thomas, 2008; Bergman& Sams, 2013; Ash, 2012; Rivera, 2015). Teachers can be doubtful about the time and quality of work done by learners watching videos.

Adequate time for implementation is another challenge staff face. O’Flaherty and Phillips (2015) explain how staffing found preparation time very intense and stressful for the flipped classroom approach. Kurup and Hersey (2013) draw attention to the difficulty staff face with the upgrading of reliable infrastructure and support from a dedicated technical team to help sustain and renew material. Similarly, Ogden et al. (2014) argue there is not enough help from administrators, senior management and other staff. Not all higher education institutions are developing support staff to help staff plan sessions and learn how to use different kinds of teaching methods. In addition, Mason et al. (2013) highlight the task of recycling old resources such as lectures and the difficulties with the time constraints of changing them into videos.

According to Herreid and Schiller (2013), learners who have spent years using traditional teaching methods, resist this new approach being taught to them. Learning systems that are not efficient and easily accessed can create situational barriers, as learners can be switched off and

irritated easily. As a result, Aydın and Demirer (2016) argue that learners can be left behind in the class modules resulting in different learning rates which are problematic for teachers to cope with. Likewise, some teachers complain about not knowing if learners have grasped the homework concepts since they have not received enough feedback from learners. Another challenge was the issue about the poor and disadvantaged learners not having access to these online platforms leaving them unprepared for learning tasks (Moorhead et al., 2013; Enfield, 2013; Milman, 2012). According to Roehl et al. (2013) it is extremely important to recognise financial limitations when using a flipped classroom approach. Access to internet and computers outside of classrooms is central to the success of the strategy. Therefore, teachers must ensure due diligence is done before implementing this learning system.

However, Yilmaz (2017) explains that the productivity of a flipped classroom will reduce over time as learners have shown to lose motivation resulting in their inclination towards taking part in activities lessen. Yilmaz (2017) argues that learner's eagerness with e-learning should be a challenge that affects gratification and enthusiasm in flipped classrooms. Similarly, Turan (2015) and Grabau (2015) agree that learner's enthusiasm and gratification is linked to the accomplishment of the online requirements of a flipped classroom. As a result, Grabau (2015) argues that learners must also have basic skills such as time management, self-regulation, self-efficiency and teamwork otherwise they will face challenges when using the flipped classroom approach. Yilmaz (2017) believes that these skills need to be a prerequisite; otherwise taking part in-class activities will be unproductive and prevent the desired results. Similarly, The New Media Consortium (2008, as cited in Callen et al., 2015) explain how learners take on more responsibility as lessons become more connected, collaborative and contextual which increases the rate of challenges.

2.14 Theoretical Framework

This research study adopts the community of inquiry theory as a theoretical framework to analyse and make sense of how blended learning and a flipped-classroom approach enhance student learning. Garrison (2009) argues that even though there has been success with the identification of asynchronous properties in learning networks, a theoretical framework was required to deal with the complexities of online learning such as transactional and educational issues. Furthermore, Garrison (2009) explains how theories that support communities of

learners have engrossed substantial consideration in higher education. According to Tolu (2013), practical inquiry, reflective thinking and socio-constructivism helped build the community of inquiry framework. It helped to establish blended and online learning settings by mixing the social dimension with community and inquiry. Garrison and Vaughan (2008) argue that in any community a social dimension exists, however, they explain that in an academic environment collective construction of meaning and critical thinking are essential in a community of inquiry. Moreover, it is argued that for online learning to be meaningful and deep, teaching presence, cognitive presence and social presence elements must interact and overlap. Similarly, Garrison et al. (2010) maintain that discourse and collaborative learning is essentially supported by the community in higher education. Furthermore, it is argued that due to the possibilities of disconnectedness and the asynchronous nature of online communication, there has been an even greater focus on the issue of community. However, Garrison (2009) contends that it is perceived learning that is associated with this sense of community. As a result of these challenges and issues, Garrison et al. (2010) were inspired to create an online learning research tool for a framework. According to Garrison (2009, p.61), the framework is made up of the following “three elements—social, teaching and cognitive presence—as well as categories and indicators to define each of the presences and to guide the coding of transcripts”.

At the interface of cognitive, social and teaching occurrence, the Community of Inquiry (COI) model can be used to explain how a group of people learn in this educational experience. Similarly, Garrison, Anderson and Archer (2000) argue that a group of individuals in an educational community of inquiry can engage and cooperate to confirm mutual understanding and create personal meaning for reflection and critical discourse.

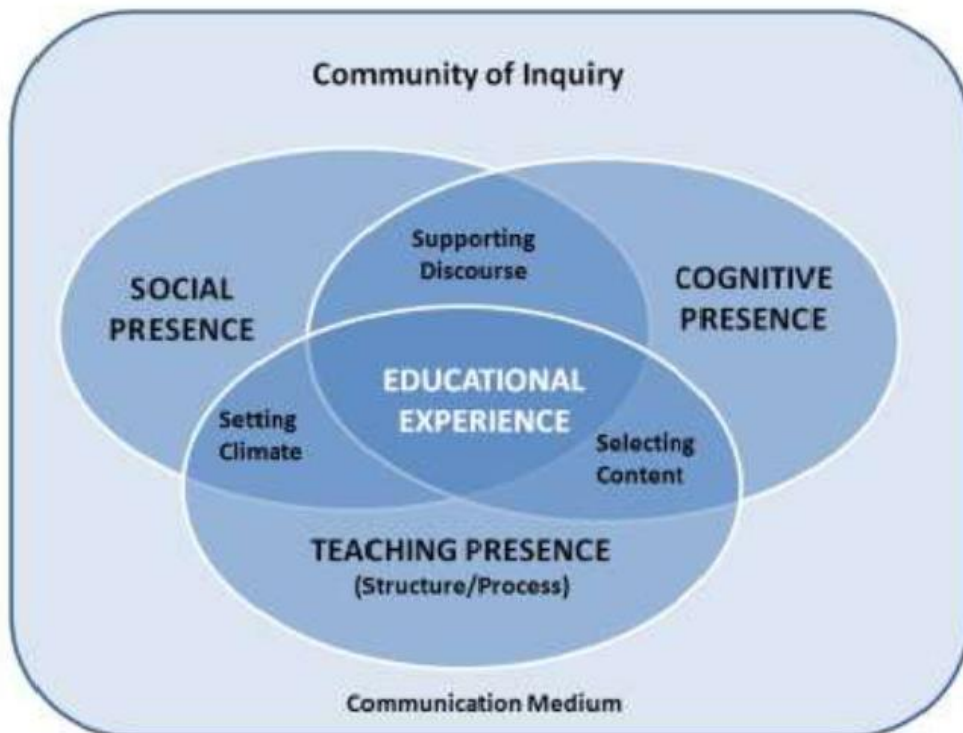


Figure 2.4: The Community of Inquiry Theoretical Framework (Garrison, Anderson, & Archer, 2000, p. 88).

There are three essential elements for an educational experience, namely. Cognitive presence, teaching presence and social presence (Garrison, 2009; Garrison et al., 2010; Garrison & Vaughan, 2008). Cognitive Presence refers to the extent to which learners can confirm and construct sense through sustained discourse and reflection (Garrison et al., 2000). Teaching Presence describes the facilitation, direction and design, of social and cognitive processes to comprehend meaningful and educationally valuable learning outcomes (Rourke, Anderson, Garrison & Archer, 2001). Social presence is “the ability of participants to develop interpersonal relationships, communicate purposefully in a trusting environment and identify with the community by projecting their personalities” (Garrison, 2009, p. 88).

Furthermore, Garrison et al. (2010) contend that each of these essential elements consist of two parts, namely, the design element and the student experience. According to Garrison et al. (2010), the design element for teaching presence consists of motivating, building understanding and instructor guidance while the student experience consists of focussing, discussion, sharing personal meaning and defining and initiating discussion. For cognitive

presence, the design element needs to propose solutions and question or challenge exploration of problems whereas the student experience must share connecting ideas, apply new ideas and have a sense of perplexity information. Lastly, the design elements for social presence need to have collaboration and a communication cluster however the student experience needs to express views encouraging collaboration for the appreciation of learning opportunity. The three elements of the community of inquiry framework, namely, the social, teaching and cognitive presence as well as the design element and student experience will be used to analyse data in this study.

The conceptual framework underpinning this research is Garrison and Vaughan's (2008) community of inquiry (COI) framework. Garrison and Vaughan (2008) designed this framework because lecturers were completing workshops on how to use technology and then returning to their classrooms to reinforce their existing teaching practice. Their professional development design would allow lecturers to create a sense of community and link their theory to practice. The social presence, the teaching presence and the cognitive presence are essential elements when using a blended approach to learning. The social presence requires open communication where there is risk-free expression, collaboration and the freedom to express emotions along with a sense of camaraderie. The freedom to express themselves in a safe environment must also be created online to enable students to feel a sense of cohesion with the class and to achieve their academic goals. The cognitive presence creates a sense of puzzlement where information can be exchanged and connected to explore new ideas. The cognitive element is where the information gathering, connection of ideas, creation of concepts and testing of solutions occurs. This is the learning that comes from the student's interaction with the material within the community of learning. The teaching presence uses the design and organisation along with direct instruction to set the curriculum and focus the discussions (Garrison & Vaughan, 2008). The lecturer is the facilitator and designer of the educational experience and must guide the learning process throughout as "Blended learning is about fully engaging students in the educational process; that is, providing students with a highly interactive succession of learning experiences that lead to the resolution of an issue or problem" (Garrison & Vaughan, 2008, p.25). This is in keeping with the experience that Tucker (2019) creates for students in her classroom. The correct integration of all three elements is considered crucial for a successful blended educational experience. Longhurst et al. (2017) identify the same elements in their research of factors that influence teacher appropriation of professional learning in the use of technology in science classrooms. Similarly, Tucker (2019) creates a

professional learning community to bring about teacher learning in adopting a blended approach. The elements in the community of inquiry are identified as successful elements in modern frameworks to implement blended teaching and learning and was specifically created by Garrison and Vaughan to research and guide the blended approach to teaching and learning. Garrison and Vaughan's (2008) community of inquiry framework was tested as a research instrument using a multi-institutional sample by Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richardson and Swan (2008). The social presence and cognitive presence were identified as valid, reliable and efficient measures for defining the constructs of an effective online learning environment, while the teaching presence depended on two factors, namely; the course design and organisation, and the instructor's behaviour during the course.

Van Blerk (2019) argue that within the framework's three elements of social presence, cognitive presence and teaching presence, there were categories and indicators identified. This is best identified using Table 2.1 as represented in Garrison and Vaughan (2008, p.19):

Table 2.1 Community of inquiry Categories and Indicators

Elements	Categories	Indicators
Social presence	Open communication Group Cohesion Affective/personal	Enabling risk-free expression Encouraging collaboration Expressing emotions, camaraderie
Cognitive presence	Triggering event Exploration Integration Resolution	Having a sense of puzzlement Exchanging information Connecting ideas
Teaching presence	Design & organisation Facilitation of discourse Direct instruction	Applying new ideas Setting curriculum and methods Sharing personal meaning Focusing discussion

Community of inquiry was chosen as a suitable theoretical framework for this study because the role of social, teaching and cognitive presence is essential in order to facilitate student engagement in learning when using online platforms and face to face. The role social, teaching and cognitive presence plays when creating a community of inquiry in a classroom helps balance socio-emotional interaction, design and facilitate higher order learning and model critical discourse which is essential in productive inquiry. This framework was used to analyse research question: To what extent does blended learning and a flipped classroom approach enhance students learning in basic electronic tools and measuring equipment in Electronic Control and Digital Electronics level 2 at a TVET College.

2.15 Conclusion

In this chapter, two key concepts, namely, blended learning and a flipped classroom approach were discussed. Various definitions of blended learning were outlined, followed by a discussion of why blend, the significance of the blended learning approach, different perspectives of blended learning, levels of blending and key models of blended learning. Thereafter, the flipped classroom approach, key methods to the flipped classroom, learning effectiveness, flipped classroom in the context of Bloom's Taxonomy, benefits of the flipped classroom and challenges of the flipped classroom were discussed. The chapter concluded with a discussion of the Community of Inquiry theoretical framework used in this study.

CHAPTER 3 - RESEARCH METHODOLOGY AND DESIGN

3.1 Introduction

The aim of this study was to explore how blended learning using the flipped classroom approach could enhance learning of basic electronic tools and measuring equipment in Electronic Control and Digital Electronics Level 2 at a TVET College. This study also aimed to improve my teaching practice using an action research design. This chapter describes the theoretical positioning, research design and methodology of this study. Firstly, the research paradigm is discussed, bringing together key characteristics and features of the ontological and epistemological underpinnings of the critical research paradigm. Ensuing, the methodological approach of the study will be summarised. Subsequently, the action research design is explained. Next, methods of data collection namely, focus groups, surveys, questionnaire and observation are detailed. Additionally, the fit for purpose of the paradigm, action research design, data collection methods and methodological approach are discussed. Lastly, the issues of trustworthiness, ethical considerations and the positionality of the researcher in this study are addressed.

3.2 Critical research paradigm

Baset (2011) argues that the Critical paradigm in educational research aims to encourage democracy by making changes in different social, political, cultural, economic, ethical as well as other society-orientated beliefs and organisations. Similarly, Bertram and Christiansen (2014, p.27) contend that “The critical paradigm sees reality as shaped by social, political, cultural, economic and other dynamics.” Critical researchers aim to transform society to address discriminations, predominantly in relation to ethnicity, gender, sexual orientation and disability. The Critical paradigm in education research deals with the domination and inequalities in society that attempts to liberate individuals as well as certain cultural groups to obtain power and have autonomy from different political, social and other barriers that exist in society (Basnet, 2011; Bertram & Christiansen, 2014; Cohen, Manion & Morrison, 2011). Another aspect is to make people counter or contest the dishonest beliefs that occur in the society and lead them in a new direction. It can also be used to argue critically and make a critical decision towards these principles. Similarly, Basnet (2011, p. 1) argues that the critical

paradigm “Also tries to capture the unheard voices within society. In addition, it attempts to question against the previous ideologies and construct the new one.”

Scott and Usher (2000, p. 35) believe unlike positivist and interpretive paradigms which are “enmeshed in dominant ideology... neither has an interest in changing the world, and neither has an emancipatory goal”. According to Patton (2002), the key idea when using the critical paradigm, is to bring change to the situation and not just try to understand and explain society. Kivunja and Kuyini (2017) argue that the critical paradigm has sometimes been referred to as a transformative paradigm since it looks to bring change and improve social justice and oppression. This allows people to speak without fear while eradicating inequalities in society. Rehman and Alharthi (2016) argue that learning approved by those in control must be analysed critically whether it be from a political or educational position. Similarly, Kincheloe (2008, p.21) agrees on this point explaining we must ask ourselves “How did I get stuck with this body of knowledge and these lenses through which to see the world?”

According to Mertens (2015), Cohen et al. (2007) and Guba and Lincoln (1994) studies done using the critical paradigm should have specific characteristics. Kivunja and Kuyini (2017, p.35) argue that these characteristics should be “The concern with power relationships set up within social structures, an examination of conditions and individuals in a situation, based on social positioning, a central focus of the research effort on uncovering agency, which is hidden by social practices, leading to liberation and emancipation and the deliberate efforts of the researcher to address issues of power, oppression and trust among research participants.” Furthermore, Crotty (1989, as cited in Scotland, 2012, p.13) believes “Critical methodology is directed at interrogating values and assumptions, exposing hegemony and injustice, challenging conventional social structures and engaging in social action.” Scotland (2012) argues that politics and inquiry cannot be separated since the aim is to empower and emancipate.

Cohen et al. (2007, p.29) assert that teachers are practitioner researchers since they promote context for practice such as “locational, ideological, historical, managerial and social.” Additionally, Cohen et al. (2007) argue that researchers obtain power from operating in the above contexts and are drivers of practice and research. As a result, Carr and Kemmis and Grundy (2003, as cited in Cohen et al., 2007, p.29) agree that this gives teachers a “voice, participation in decision making, and control over their environment and professional lives.”

Freire (2014, as cited in Scotland, p. 14) argues “participants and researchers are both subjects in the dialectical task of unveiling reality, critically analysing it, and recreating that knowledge”. Researchers working together with participants enable transformation. Thus, participants that actively partake in the research by collecting, analysing, designing data can benefit from the research. Political, cultural and historical stances allow for realities to be critically examined when using critical methods. These methods could include journals, open-ended observations, open-ended questionnaires, focus groups and open-ended interviews. Data is often analysed using thematic interpretation however there must be clear values representing the interpretations. Similarly, the research should encourage and bring about enhancement and change for the participants.

This study is aligned to the critical paradigm, which looks to empower and emancipate the researcher and the learners participating. The use of this paradigm was to give the researcher more significant influence in the decision making and control over his professional environment. Likewise, this paradigm also empowers the learners simultaneously, by allowing them to take control over their learning decisions, choosing their levels of participation and work with the lecturer at a level and pace of their choosing. This eliminates the inequality of a one size fits all teaching model for learners. The learners explained the meanings of the findings through focus groups, observations, questionnaire and survey completed in their classroom. The emancipation of learner and researcher are intertwined together due to their increased time spent on collaboration in the classroom in this study.

Using the critical paradigm in this study, the researcher aims to acknowledge the theories and activities that constrain individual independence while trying to transform that situation. The critical paradigm in education should be used to face those responsible in creating or assisting such unfair structures that allows for disparity and subdued individuals. Therefore, the critical paradigm is suitable for this study which aims to empower a TVET College lecturer to use blended learning and a flipped classroom approach to enhance student learning. This research used the critical paradigm as the purpose of this study was to be emancipatory, resulting in the elimination of unjustified isolation and authority in the learning environment, consequently promoting and encouraging individual capability. As a result, the critical paradigm builds on the epistemological notion that individuals are responsible for shaping social reality, while objective viewpoints can impact observations.

3.2.1 Ontological and epistemological assumptions of the critical paradigm

Kivunja and Kuyini (2017) argue a critical paradigm should have an epistemology based on the researcher being able to react with the participants (transactional epistemology), and the ontology should be historical realism as it deals with oppression while the methodology should be dialogic. Likewise, Guba and Lincoln (1994) argue the methodology for critical research should be dialectical and dialogic since researchers must participate with the individuals to open their minds to how social classifications are failing their academic needs.

However, Scotland (2012) argues the different ways we go about discovering and understanding knowledge is subjective. A researcher's assumptions and subjectivity influence their ontological and epistemological ideas. Similarly, Rehman and Alharthi (2016) argue that the critical paradigm epistemology should be subjective as the study is influenced by the researcher. Crotty (2003) explains ontology as showing what constitutes reality and how researchers align their perceptions of how things really work when compared to how they really are. Kincheloe and McLaren (2005, p.305-306) affirm the importance of researchers understanding their own epistemological beliefs when completing research so "no one is confused concerning the epistemological and political baggage they bring with them to the research site."

Cohen et al. (2011) argue epistemology looks at the forms and nature of knowledge explaining what it might mean to know, understanding how knowledge can be acquired, communicated, and created. Similarly, Crotty (2003, p.3) argues that epistemology can be defined as "a way of understanding and explaining how we know what we know." Correspondingly, Guba, and Lincoln (1994, p. 108) explain that epistemology asks the question, "What is the nature of the relationship between the would-be knower and what can be known?"

However, Feast and Melles (2010, p.1) argue there are three key positions to consider when constructing theories that help "designing as either, direct making, reflective practice or rational problem-solving and which broadly correspond with subjectivist, constructionist and objectivist epistemologies." On the constructionist point, it can be argued that the design of the research is not relevant unless there is a component of reflection during the research process. According to Crotty's knowledge framework, this research falls under constructionism. As a

result, Feast and Melles (2010) affirm this study is based on the theoretical perspective being of critical inquiry, the methodology supporting action research model and methods allowing for observation and interviews, all of which confirm to this study.

Scotland (2012) affirms ontological and epistemological presumptions are dependent on its specific paradigm and can be reflected in the methods and methodology of the study. Scotland (2012, p.13) uses Guba and Lincoln to explain how historical realism shapes the ontological position in the critical paradigm arguing “Historical realism is the view that reality has been shaped by social, political, cultural, economic, ethnic, and gender values; reality that was once deemed plastic has become crystallised.” However, societal ideology is linked with real world phenomena and subjectivism when describing critical epistemology. Similarly, Scotland (2012) argues that information is both influenced and socially built within society due to power relations. Likewise, Cohen et al. (2011, p. 27) explain that, “what counts as knowledge is determined by the social and positional power of the advocates of that knowledge.”

In this study the researcher’s own understanding, thinking and past experiences helped shape my ontological and epistemological beliefs. These beliefs also shape and guide my understanding and rationale with regards to my methods, research methodology and social research. As a matter of fact, the researcher’s epistemological and ontological position has developed from my experience and training as an artisan in industry and shifting that experience and knowledge to a vocational classroom in a TVET College. His reflection from learning experiences as an artisan and student in college has led to my ontological epistemological assumptions in social research. Industry training and experience resulted in me being more inclined to a positivist approach where one is informed mainly by realism, idealism and critical realism where there is one reality, knowable within probability. However, the researcher years as a lecturer in vocational education and training has also contributed to his ontology and epistemology specifically around understanding and development in philosophical arguments which has allowed him to relate and critically think about actual learning and teaching strategies in his classroom. This has been informed by race specific philosophies, postcolonial discourses, feminist philosophies and critical philosophy.

As a result, the researcher’s epistemological and ontological position for this research is based on the belief that knowledge exists and is obtained through evidence but is shaped by multiple realities due to disability, gender, ethnic, economic, social political and cultural values.

Likewise, it could be argued that due to human belief and perceptions there are other forms of getting and proving evidence using an interpretive standpoint. As a result, experiences and knowledge is highly approximate and subjective and can limit the understanding and interpretation of people's beliefs and perceptions of reality.

3.3 Action Research

An action research design was used in this study to address the following research question:
To what extent does blended learning and a flipped classroom approach enhance students learning in basic electronic tools and measuring equipment in Electronic Control and Digital Electronics Level 2 at a TVET College?

Brydon-Miller, Greenwood and Maguire (2003) describe action research as an approach that developed over time, which can be applied to an extensive number of disciplines. This action research study was required to investigate, identify and solve problems while analysing information about the college and the learning environment. Action research can be used to solve a problem immediately or it can make use of a continuous reflective process for progressive fault finding that makes use of integrated research, action and analysis. Alternatively, Carr and Kemmis (2003, as cited in Hagevik, Aydeniz & Rowell, 2012, p.675) describe action research as “improvement of practice, understanding of practice and improvement of the situation in which the practice takes place”. Action research is a cyclical process which comprises four steps, namely, planning, acting, observing and reflection which is required throughout all the steps for the researcher to make new discoveries (Koshy, 2009; Macintyre, 2007; Bertram & Christiansen, 2014). On the other hand, Koshy, Koshy and Waterman (2011) argue that steps can overlap and become superseded therefore preferring to describe action research as spiral in nature, which increases understanding and progress. As a result, Kemmis and McTaggart (2002, as cited in Koshy et al., 2011, p.5) describe action research as repetitive cycles of reflection containing the following steps: planning a change, acting and observing the process and consequences of the change, reflecting on these processes and consequences and then re-planning, acting and observing, reflecting and then repeating the process as required. This study makes use of action research as described by Koshy (2009).

Parsons and Brown (2002) argue that participating actively in the classroom, analysing, observing and understanding how learners' study and use information are the requirements of

an effective teacher. According to Kenney and Newcombe (2011), action research can cater to this methodical way of reflecting on engagement. This action research study of blended learning using the flipped classroom approach was proposed to measure enhancement in student learning at a TVET College and improve teacher practice. McAteer (2013, p.11) describes action research methodology used within a qualitative research as “which serves the purpose of engaging people in activities that explore and seek to understand practice and its impact.” Action research is best used when one requires making improvements to processes, once they complete analysis and reflection. Cohen et al (2011, p.359) argues a key characteristic stating “reflexivity is central to action research, because the researchers are also the participants and the practitioners in the action research”.

According to Rehman and Alharthi (2016) action research can be used as it supports the critical paradigm in transforming social structures created from inequality and discrimination. By using the action research, researchers can cater for change whilst at the same time study the effects of the research. Action research shares similar concepts and ideas with critical paradigm, as they agree that information does not exist in a void but needs to be applied to meaning to be fully understood. As a result, action research appears to fit the contexts for this research question, as it ties in on the researcher’s philosophical beliefs and understanding the research paradigm and theoretical framework.

3.3.1 Step1: Strategic Planning

McGill (1973, as cited in Jefferson, 2014) argues that this is the stage where planning takes place that will lead to the action required. This requires teacher reflection on their teaching practice so that a problem can be identified, then generating data on the problem and using the data to create a plan of action (Jefferson, 2014). Having reflected on my teaching practice, subject guidelines and learning outcomes, I noticed gaps in my students’ learning. Due to the way the module is prescribed to be taught, large class numbers, limited time and learners’ different cognitive levels; learners do not understand the work set out by the module. As the marks allocated for this module is low in the first year of their studies, students tend to not learn for this module. As a result, this could have disastrous consequences overall as the knowledge required from this module should be used in the next two years of the program and

the allocated marks are much more substantial than in the first year. By using the flipped classroom method, I hoped to be able to address these problems. The importance of maximising classroom time on dynamic teaching and learning and the benefits it has towards learners are well documented (Long et al., 2014; Mason *et al.*, 2013; Johnson & Renner, 2012; Snowden, 2012). After Ethical Clearance had been approved, I applied for permission from the management of Umgungundlovu TVET College to conduct this action research study. I also sought permission from participants of this study, ensuring that the ethical principles of informed consent, voluntary participation and withdrawal, anonymity and confidentiality were explained to participants. I hoped to encourage a relationship based on trust where participants can speak honestly without the fear of repercussions and victimisation no matter what the outcomes of the study. As this research falls within the critical paradigm, this research should have traits of critique, emancipation and transformation as maintained by Bertram and Christiansen (2014) and Jefferson (2014).

3.3.2 Step 2: Taking action and implementing the plan

Through reflection and reviewing literature, I designed an intervention that would be implemented. Macintyre (2000) refers to this step as a chance to collect data which would be used as evidence to answer a research question. Evaluating different teaching strategies and introducing different approaches to classroom space and organisation, I believed that this would result in an improvement in the learning of this module as explained by Macintyre (2000). Bertram and Christiansen (2014) explain how reflecting on your practices, increases self-awareness to improve a situation thus resulting in a transformation of the teacher and learners. During the lectures, I planned to use the flipped classroom approach. The following data generation instruments were used: social media platforms, observations, questionnaire and focus group discussion to improve learning. By changing the teaching style, I employed multimodal pedagogic practices, varied pace and enhanced the ability to inspire and value students.

Concerning the learning experience, the intervention included uploading videos and documents that covered the different aspects of the module and involved the students affectively, physically while challenging them to engage and reflect. Multimodal teaching approaches and

frequently switching between pedagogic styles was implemented. The diversity of styles included classroom examples and theoretical perspectives; discussion; questioning; practical activities (even in the lecture); and student enquiry. An additional method to teaching creatively involved the use of technology such as Google drive and WhatsApp to devise ways of improving the teaching and learning process. Technology is a necessary tool that undoubtedly made its way into the lives of students and the field of education. However, it was important not to dismiss the importance of face-to-face learning.

3.3.3 Step 3: Observation, evaluation and self-evaluation

Once all class activities and subject overviews were completed, questionnaires were handed out to rate the proficiency of the overall module. The questionnaire covered categories such as teacher ability, classroom teaching and learning and computer mediated activities. This data collection tool with the observation schedule, focus groups and social media platforms provided valuable data on how successful/unsuccessful the strategy was. The observation schedule used was based on a national assessment tool used for the Integrated Summative Assessment Task and was used during the building of circuits for practical lessons. This observation tool was also a testing tool which carried a pass mark of fifty per cent.

The students were then given structured questionnaires for feedback regarding the new intervention and strategies. There was a focus group discussion with selected students; which allowed me to probe further about the feedback received from the questionnaires. By making use of numerous data generation tools, this ensured that there was triangulation thus making the evidence more credible. The questionnaire, observation schedule and survey generated quantitative and qualitative data. The focus group discussions allowed me to listen to views of the learners generating rich qualitative data. In contrast, data from the observation schedule further strengthened the data from other data collection methods. This step was vital as it allowed for observation and analysis of the data.

3.3.4 Step 4: Reflection

Once the data had been processed, reflection could take place. I could determine whether the plan of action or intervention was a success or failure, whether certain aspects of the plan were successful while other parts needed to be revised. Improvements and changes to the strategy plan could only be made after observation, evaluation and self-evaluation had been completed, which was dependent on the analysis of the data. If required, the plan could be implemented again with the desired changes to improve results. This action research study consisted of two cycles, that is, a cycle for each video and slide for each sub- section of the module that was uploaded.

Following the context of this research, I used the critical paradigm to emancipate my teaching approach and give learners options and greater control over their individual needs and learning. I was also able to gain relevant data about learners' perception and understanding of blended learning using the flipped classroom in a TVET College. The critical paradigm allowed me to empower myself as well as learners, while also encouraging and promoting individual ability and removing unfair exclusion and influence in the learning environment. The use of an action research design further enhanced this research study as it allowed me to make changes to certain aspects of this study, which further improved or assisted learners in their learning.

According to Gebhard (2005), action research could act as a problem-solving process, which allowed lecturers to investigate, identify and solve problems in their teaching processes. Lecturers could use action research to process problem solving within the classroom and community and its effects on classroom learning and teaching. Action research could also address teaching practices and beliefs through reflective skills gained. Iliev (2010) argues that benefits of action research could be broken down into three parts, lecturer orientated, learner orientated and process orientated.

Firstly, with process orientated the benefits of an action research could: improve greater understanding between the learner and lecturer, influence the accomplishment of learning and teaching goals, support methodological processes when implementing learning and teaching processes and develop the application of changes in classroom learning. Secondly, in learner orientated benefits: learners develop abilities for self-evaluation, gain better personal abilities,

learners increase their role of decision making in the classroom leading to learners taking control of their learning and learning environment. Lastly, in lecturer orientated benefits, the lecturer reflective processes are improved, the self-confidence of lecturers are improved and teaching practices could be improved.

However, there were limitations to using action research. Iliev (2010) suggests that there are two main types of limitations to consider, namely, methodological and physical limitations. Iliev (2010, p. 4210) describes physical limitations as “ The pupils have physiological inability for critical thinking due to the age and can't focus their attention for a long period of duration of the action research”, and methodological limitation as “ the structuring of the instruments for data gathering, persistence of the ethical principles in realization of the action research, producing the system of knowledge based on the results of the research, complete dependence of the implementation of the results from the others.”

3.4 Overview of plan implementation

From the syllabus of electronic control and digital electronics, the module on basic electronic tools and measuring instruments was selected to be used for this action research study. The module was broken down into two parts, catering for the two cycles of action research. During each cycle, learners needed to build a simple electronic circuit which was assessed using the observation schedule. Both circuits would be of easy to medium difficulty as per curriculum using specific learning material uploaded to the online drive. Worksheets, learning aids and videos were created for the modules that were used in this intervention. Selected work was uploaded onto Google drive at specific times, for learners to go over and prepare in advance for the face-to-face lesson. The aim of this was to allow learners to use their time away from the classroom to construct their own learning and understanding. This was to allow for more active learning to take place in the classroom while using the limited time in the classroom more constructively. This freed up time and allowed learners to spend more time on practical aspects of their work and to improve on the construction of the circuits and their assessment marks.

The face-to-face lessons that took place on campus during cycle 1 and cycle 2 involved learners being in the workshops completing practical lessons. There are no lesson plans designed for

these practicals but practical lessons are guided by outcomes set by DHET and the college, which the lecturer must use his/her discretion to get best outcomes out of learners. For each practical lesson, I aligned the practical work to correspond with the module “Basic Electronic Tools and Measuring Instruments” and work being discussed and taught on the online platforms. Before each practical lesson could take place, the theoretical work was uploaded on the online platform a few days earlier for learners to go through and help prepare for the face-to-face lesson. These were normally notes from textbooks, worksheets, summarized notes and videos of the tools being used. This was done to use more time in practical lesson for practical activities and not explaining theory concepts. Using my practical experience in industry and teaching experience in a TVET college, this decision was taken to separate the practical and theory using blended learning to get best outcomes for learners while also noting the knock-on effect the Covid-19 Pandemic could also have on teaching and learning. Certain lessons were manipulated to suit the Pandemic regulations and not disadvantage learners, such as group work and collaboration activities.

At the beginning of each lesson, learners had to identify tools and measuring instruments in the workshop that were discussed on the online platforms. This was done to make understanding easier for learners while also allowing the lecturer to follow progress of each learner. This method also allowed the lecturer to identify key issues learner were facing using this strategy. The next step of the practical lessons involved learners understanding how to correctly use these tools in a practical environment. Tools differed from lesson to lesson depending on how well learners progressed in the previous lessons. These methods were introduced to blend theoretical and practical work of the module selected in each cycle. Below are the first and second cycle explaining in a little more detail how action research was applied in my workshop with my learners using this new strategy.

The first cycle

3.4.1 Step1: Strategic Planning

The first cycle of action research focused on the first half of the module, which took place from March 2020 until July 2020. The extra long-time frame was not part of the initial plan but had to be accommodated due the Covid-19 pandemic which the country faced at that time. The

online and face to face lessons went according to schedule. Teaching and implementation of my plan went ahead, to keep up with my syllabus and assessment schedule. When ethical clearance was approved, the college and country were put into level five lockdown. However, I was communicating and advising learners through the online platforms being used. This cycle used the data generated by the two sub-modules: Identifying basic electronic components and measuring instruments, and building simple circuits.

3.4.2 Step 2: Taking action and implementing the plan

For the first cycle, specific videos identifying certain measuring tool and basic electronic equipment were uploaded onto the online platform Google drive. Thereafter, worksheets were uploaded providing diagrams, safety procedures, summarised notes and instructions and requirements of the face-to-face lessons.

Learners were given three days to go over the online content before doing a face-to-face lesson. Learners had to notify me on the WhatsApp group chat as soon as they downloaded the information and when they had completed going through the information. The group chat was also used for help and support from the learner's peers and me. Before the face-to-face lesson, each learner had to message me personally and not via the WhatsApp group chat to let me know if they had a problem with the specific content that I needed to address. This was done so learners would not feel pressured and embarrassed by their classmates who had completed the work. These WhatsApp messages also allowed me to monitor the progress of individuals in the group and the timeframe taken to complete the work while also allowing myself to prepare specifically for key issues, make extra notes and arrange learners in groups where specific learners could help them. This saved teaching and learning time during the face-to-face lesson and helped me to focus more on practical work and active learning. Learners had a total of four days due to the timetable, to go over, understand, and collaborate with peers and me before the start of the first face to face lesson.

3.4.3 Step 3: Observation, evaluation and self-evaluation

There were four face-to-face lessons conducted over six days in the first cycle. Learners also used the WhatsApp group chat to discuss activities from the face-to-face lessons. The final face-to-face lesson was used by learners to build their electronic circuit. During this lesson, I

used the observation schedule to collect data. The observation schedule used was taken from Integrated Summative Assessment Task (ISAT) used by DHET (Department of Higher Education and Training) for assessment. This allowed me to assess how well learners were progressing against relevant criteria for this vocational subject. It also served as a test document which could be used to show differences between the criteria in both cycles of implementation. In the lesson after the building of the circuit, learners were given a specific questionnaire for feedback on the first cycle. The questionnaire asked for their input on 10 questions using a Likert scale during the first cycle and what could be done to improve the process during the second cycle thus improving their learning and understanding.

3.4.4 Step 4: Reflection

3.4.4.1 Feedback from learners

This was done in the form of a questionnaire for cycle one. The questionnaire for cycle one was sent to learners using WhatsApp for them to answer in April 2020. A few learners did use this platform and give the required feedback; however, the remaining learners answered the questionnaire when they returned to college in July 2020. The remaining data collection for cycle one was completed by the end of July 2020. Firstly, learners made some verbal suggestions pertaining to the date of the upload for the second cycle. Initially, the second half of the module was supposed to be uploaded on the third week of July 2020. Learners suggested I upload seven days earlier. Their reasoning for some were the following week they were writing a Maths test and it would increase their workload, others said they would prefer to start early and have extra days to go over the online work without impacting their test. After discussion with learners, we agreed to bring the upload days forward by a week. This was a positive sign, as I got learners to take responsibility and control over their learning and open more collaboration and flexibility between myself and learners. Secondly, some learners asked if the documents and worksheets that I uploaded could be printed by them in the life orientation room. This required me asking for permission from a colleague at work, to allow learners to print in his venue. Learners argued that some of them preferred to have the information in hard copies as it was easier for them to go through them, instead of reading them from a screen. After making the arrangements with my co-worker, learners were informed that they would be allowed to print these documents during their lunch break. Lastly, a few learners complained

about not having enough data to go through the videos at home. Those learners were given USB drives with videos loaded onto them to use after class.

3.5 The second cycle

3.5.1 Step1: Strategic Planning

Unlike the first cycle, learners were given ten days to go over the online content as a result of their suggestions in the feedback session of cycle one. The procedures were the same as cycle one, learners had to notify me when they downloaded the content and when they were finished and ready for the face-to-face lessons. Learners also had to notify me of specific difficulties faced with the online content personally via WhatsApp. Like cycle one, this allowed me to prepare adequately for face-to-face lessons.

3.5.2 Step 2: Taking action and implementing the plan

There were changes made to the way face-to-face lessons were approached during cycle two. This was a result of Covid-19 regulations set out for TVET colleges by DHET. Colleges were allowed only thirty three percent of the total number of learners on campus at any given time. As a result, the timetable was changed to accommodate this regulation. A three-day cycle per level was created, however this meant that the four face-to-face lessons planned for would be done over three weeks. Consultation with my senior lecturer and colleagues at work allowed for me to reduce this time to eight days. This was done by swapping classes with other lecturers to see the learners earlier and giving those lecturers a chance to take my classes at a later date. As a result, face-to-face lessons commenced on the first week of August 2020 and only finished two weeks later.

3.5.3 Step 3: Observation, evaluation and self-evaluation

Learners were also spaced 1, 5 meters apart in class, wearing face masks and face shields and with social distancing being practiced, collaboration work was removed and replaced with more discussions and practical assessment activities. Unlike in cycle one, I allowed learners to

communicate and discuss their practical activities and ideas in class amongst themselves to cater for the loss of collaboration and teamwork. Likewise, the WhatsApp group created was used by learners more extensively in the second cycle as a method of collaborating with one another after face-to-face lessons, than compared to cycle one. The building of the practical circuit on the third day was not affected by Covid-19 regulations as the class size consisted of twelve learners only and my workshop catered for that number easily and safely without being affected by regulations. Each learner had to sanitise their hand tools before and after use which was not a requirement in cycle one.

3.5.4 Step 4: Reflection

3.5.4.1 Feedback from learners

This was done on the questionnaire from cycle two. On day four of the face-to-face lesson of cycle two, feedback was given by learners. This was specific feedback on the questionnaire pertaining to cycle two. Unlike cycle one; learners had no verbal complaints or suggestions in the face-to-face lesson. Once that was completed, they were then required to fill in the questionnaire for the overall implementation of this teaching strategy and plan. Learners were then put into three groups of four for the focus group discussions which was completed on the last week of August 2020. This was the final step of my data collection ensuring all data collection was completed and ready for the next step of data analysis.

3.6 Research setting

This study was conducted at a TVET College in Pietermaritzburg, located in the province of KwaZulu-Natal, South Africa. The TVET College consists of 5 campuses located throughout Pietermaritzburg. It has three engineering campuses which cater for electrical, mechanical and civil engineering students and two campuses that cater for commerce and various other courses. The campus that was used is the Electrical campus that is situated in the suburb of Northdale. Northdale is an urban area and is predominately an Indian community but the campus consists of 95% African students and the remaining 5% caters for other races. Many students travel using public transport from the local townships within Pietermaritzburg to get to campus. There are also many students from very rural towns and villages such as Impendle, Greytown, Tugela

Ferry and Wartburg who also attend this TVET College as it is the most convenient for them. In recent years there has been a surge in the number of students enrolling from the Eastern Cape Province at this TVET College.

3.7 Sampling strategies

According to Dawson (2007), sampling is a technique used to select and manage participants in a research study. Similarly, Hill (2012) argues that when doing research, one must consider if the sample chosen can effectively answer the research question providing rich data. Nundkoomer (2016) believes that the sample selected must be able to give valuable accounts regarding the phenomenon being investigated. The researcher noted that the quality of data collected was vital for this study. Therefore, this study made use of purposive and convenience sampling. As I lecture to three different levels for the same subject, purposive sampling was used to specifically select the level of learners to be part of this research. As the researcher, I purposively selected level two learners to be part of this study due to the gaps I found in learner knowledge at levels three and four, thus choosing to correct this at the starting level.

The sample included sixteen learners from a level two class of Electronic Control and Digital Electronics at a TVET College. Convenience sampling was used as I currently lecture at the TVET College. This was due to the convenience, availability and accessibility of participants of the study. According to Mertens (2004), this type of sampling is used when participants in the study are readily available. However, Mertens (2004) argues that there are limitations with this sampling, and one should not attempt to generalise the results beyond this sample. Of the sixteen learners, nine are females and the remaining seven are male learners. They are all of African descent and their ages ranged from 18 to 28 years old. All participants use English as their second language. The first language used differs among participants, while majority were Zulu speaking, there were also Xhosa, Swahili and Tswana speaking learners. There was a vast range with regards to participants' highest academic qualification. Some learners had only completed a grade nine, while others had completed a matric qualification. Two learners had completed their necessary studies in a foreign country. In the focus group discussion, learners were grouped into three groups of four learners. Initially, there were sixteen participants selected for this study; however, one participant left due to his family relocating, and another three participants left the study as they chose not to return to college due to the Covid-19

pandemic. Therefore, data was generated from a convenient sample which comprised of twelve Level 2 learners from a TVET College.

3.8 Data generation

Data generation is the process of systematically collecting data that represents the opinions and experiences of its participants. Focus group discussions, questionnaires, survey and observation are the primary data collection tools for this study.

In this study which adopted an Action Research design, data generation instruments generated both quantitative and qualitative data. The questionnaire, observation tool and part of the survey with closed questions generated quantitative data. The purpose of the survey was to obtain a broad view of the population so that clarifications could be made about some qualities, mindsets, or behaviours of the participants (Creswell, 2014; Cohen et al., 2011; Mertens, 2015). The quantitative data was collected using questionnaire, observation tool and survey forms and analysed using Microsoft Excel to design graphs and tables summarising participants' responses to questions. Descriptive statistics was employed to analyse the quantitative data. The focus group discussions and part of the survey with open ended questions generated qualitative data. Thematic analysis was used to analyse qualitative data generated from the focus group discussion and open-ended questions of the survey. Codes and themes were generated from thematic analysis (Creswell, 2014; Nieuwenhuis, 2007; Mertens, 2015). The study accordingly used inductive codes. The emergent themes were guided by the Community of inquiry framework discussed in the previous chapter.

According to Rehman and Alharthi (2016), data generated in critical research can be of a qualitative or quantitative nature, this allowed for learners also to give detailed information on their perception, expectations and experience using blended learning and the flipped classroom (Cohen et al., 2012; Mertens, 2015; Creswell, 2007). Even though this research was located within a critical paradigm, data collection instruments that generated quantitative data were used to strengthen limitations of qualitative data whilst also providing meaningful data (Cohen et al., 2012; Mertens, 2015; Creswell, 2007). Questionnaires were used to discover any additional aspects and give a statistical aspect to the research while also strengthening the research's credibility, dependability and confirmability (Bertram & Christiansen, 2014).

3.8.1 Focus group discussion

According to Cohen et al. (2011), focus group discussion can be considered a flexible data collection tool that makes use of multi-sensory channels. These channels are further explained as non-verbal, verbal, heard and spoken. Furthermore, Cohen et al. (2007) affirms that the interview order can be controlled while still giving the opportunity for spontaneity. Likewise, Mertens (2004) and Cohen et al. (2011) explain that an interview allows the researcher to probe on completed as well as get responses on deeper and complex issues. I planned focus group discussions with three groups each containing four learners. Participants were placed in each focus group depending on their responses in the questionnaire. They might have ideas, solutions or problems that the questionnaire did not cater for them to answer in detail. Focus group discussions allowed me to probe further about the feedback received from the questionnaires.

3.8.2 Observations

According to Cohen et al. (2011), the observation tool allowed researchers the prospect to collect data from social situations naturally. Furthermore, Cohen et al. (2011) and Nieuwenhuis (2007) agree that observation tools allow researchers to collect data for specific situations; these are explained as the human, interactional, programme and physical setting. The observation schedule used is based on a national assessment tool used for the Integrated Summative Assessment Task (ISAT) and was used during class practical lessons when building circuits. After implementing the teaching strategies, there were class activities and subject guideline overviews that needed to be completed. The structured observation was based on these activities. During the observation, I looked for improvements in class participation, group work activities, and practical skills when using electronic tools and measuring equipment, leadership skills in group work, class activities and housekeeping.

3.8.3 Questionnaire

Cohen et al. (2011) contend that questionnaires are the most widely used tool for collecting information. Cohen et al. (2011) and Mertens (2004) argue that the questionnaire can provide numerical data that can be structured with or without the presence of the researcher. The questionnaire used made use of the Likert scale and was used in both cycle one and two. The

five options available for learners to choose from were strongly disagree, disagree, neither agree nor disagree, agree, strongly agree. This was done so a comparison could be done between the two cycles.

3.8.4 Survey

Cohen et al. (2011) assert that survey questionnaires are used to produce meaningful and comparable responses from participants. Similarly, Mertens (2004) and Nieuwenhuis (2007) explain how survey questions have become better tools for providing feedback for cognitive quizzing, behaviour encrypting and theoretical perspectives. The participants were given a survey for feedback regarding the new flipped classroom approach. The survey generated data on the strengths and shortcomings of the intervention. The survey focused on collecting data on four categories: online learning, face-to-face learning, challenges and the overall effectiveness of the flipped classroom approach. The survey contained a mixture of open and closed ended questions. Closed ended questions had three options to respond: Yes, No and Sometimes, while the open-ended questions required students to write their suggestions and feedback about the intervention or flipped classroom approach.

In the context of this research, specific emphasis was based on teaching Electronic Control and Digital Electronics at a TVET College. Using my years of experience in industry and teaching, I was able to interpret data and information from learners with these new methods of teaching and learning. There are numerous researchers such as Creswell (2007), Marshall and Rossman (2014) and Hatch (2002) who affirm that there are crucial characteristics that a research study must contain within a specific context. These concepts are explained for this research study in the table below and also strengthen the use of action research as a research design.

Table 3.1 Characteristics of this research study

Characteristic	How Qualitative research applies to this study

Researcher is the key instrument	The lecturer is the individual that utilised an action research methodology. He is also the lecturer and researcher in this study. Therefore, he is at the centre of this research
Natural setting	All data collection took place at the same location where the research was done. The researcher taught the subject without changing the environment the learners were accustomed too. The research/lecturer also observed all activities with learners in this blended learning flipped classroom approach. Feedback by learners were required on certain days but this is not an unfamiliar process to learners. All attempts naturally possible were made to keep the learning environment unchanged during the study
Should have meaning to the participants	Learners exposed to higher order thinking skills, technological skills, development of communication and social skills, emancipation of their learning and learning of relevant skills for real life application.
Must have a reflexive approach	Since the researcher and lecturer is the same person, he was able to continuously reflect on the process and feedback from learners during this study. All data obtained went through analysis to ascertain whether further action was required. As a result, modifications could be made to better improve the flipped classroom approach in a blended learning environment with aim to improve learner education in following cycles.

The use of multiple sources of data is required	This study used several sources to obtain data. These included focus groups, questionnaire, observation and social media platforms such as Google drive and WhatsApp.
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The use of data collection tools which generated both quantitative and qualitative was appropriate for this study, since it centred around the empowerment and emancipation of a group of learners and a lecturer. Learners were interviewed using focus group discussions about their interpretations, perceptions and clarifications on the intervention used. Data was also obtained using open-ended questions in the focus group discussions and survey, observation schedule and questionnaire.

3.9 Methods of data analysis

The quantitative data generated from questionnaires, observations and part of the survey used descriptive statistics to analyse data. Cohen et al. (2011) contend that descriptive statistics are regularly used on a sample to evaluate attributes of a population. These traits or characteristics that we evaluate an individual or other source are repeatedly called variables, because they vary from person to person. Focus group discussions and part of the survey generated qualitative data. This study made use of thematic analysis to interpret and make sense of the qualitative data. According to Ayres (2007), thematic analysis is used when questions ask: what are the reasons individuals have for operating or not operating a procedure or service. What are the concerns of individuals about an event? Likewise, Sparkes (2005) argues that thematic analysis is used for critically probing narrative resources and then breaking it down into smaller themes of content which is then exposed to a descriptive process. Collecting and analysing information are conducted simultaneously in descriptive qualitative approaches, thus adding to the depth and value of data analysis like many other qualitative methods.

Braun and Clark (2006) contend that thematic analysis is a more flexible and beneficial investigation tool as it delivers more detailed and productive, yet intricate, explanation of data. This approach is mostly based on the fascist perspective. Sandelowski (2010) explains a fascist perspective as assuming information to be less or more accurate and reliable indexes of reality.

According to Ten Have (2004) this is when the researcher needs to discover the real behaviour, mindsets, or real motivations of individuals in the study, or to expose what happened.

Similarly, Braun and Clark (2006) argue that it could also be used to identify all data that relate to the already classified patterns. Data that fits under the specific pattern is identified and placed with the corresponding pattern. The next step of thematic analysis is to combine and arrange related patterns into sub-themes. Themes are recognised by grouping similar data, which could be meaningless when alone but hold vital information when grouped. Cohen, Manion and Morrison (2011) argue that by doing this it is easier to see emerging patterns. Undoubtedly, the use of thematic analysis allows one to explore and find common themes across an entire set of collected data. However, Braun and Clark (2006) assert that thematic analysis must provide thoroughly qualitative, comprehensive and nuanced account of data.

Similarly, Cohen et al. (2011) uses thematic analysis to explain how words can be grouped into fewer categories. Cohen et al. (2011) argue that thematic analysis can be used for structured and unstructured communicative material which can contain social structure and interaction. Gbrich (2012) maintains that a benefit of using thematic analysis is it allows data to be analysed qualitatively while also quantifying the data. By allowing data to be analysed qualitatively and quantifying it, a descriptive approach can be used. According to Cohen et al. (2007, p.476), thematic analysis is ideal when applying “to substantive problems at the intersection of culture, social structure, and social interaction; used to generate dependent variables in experimental designs; and used to study groups as microcosms of society.”

Likewise, Cohen et al. (2007) contend that thematic analysis could be achieved from data collected with any written material from transcripts of interviews to media products while also being an unobtrusive technique. Weber (2010, as cited in Cohen et al., 2007. p.476) argues that the purposes of thematic analysis include “the coding of open-ended questions in surveys, the revealing of the focus of individual, group, institutional and societal matters, and the description of patterns and trends in communicative content.”

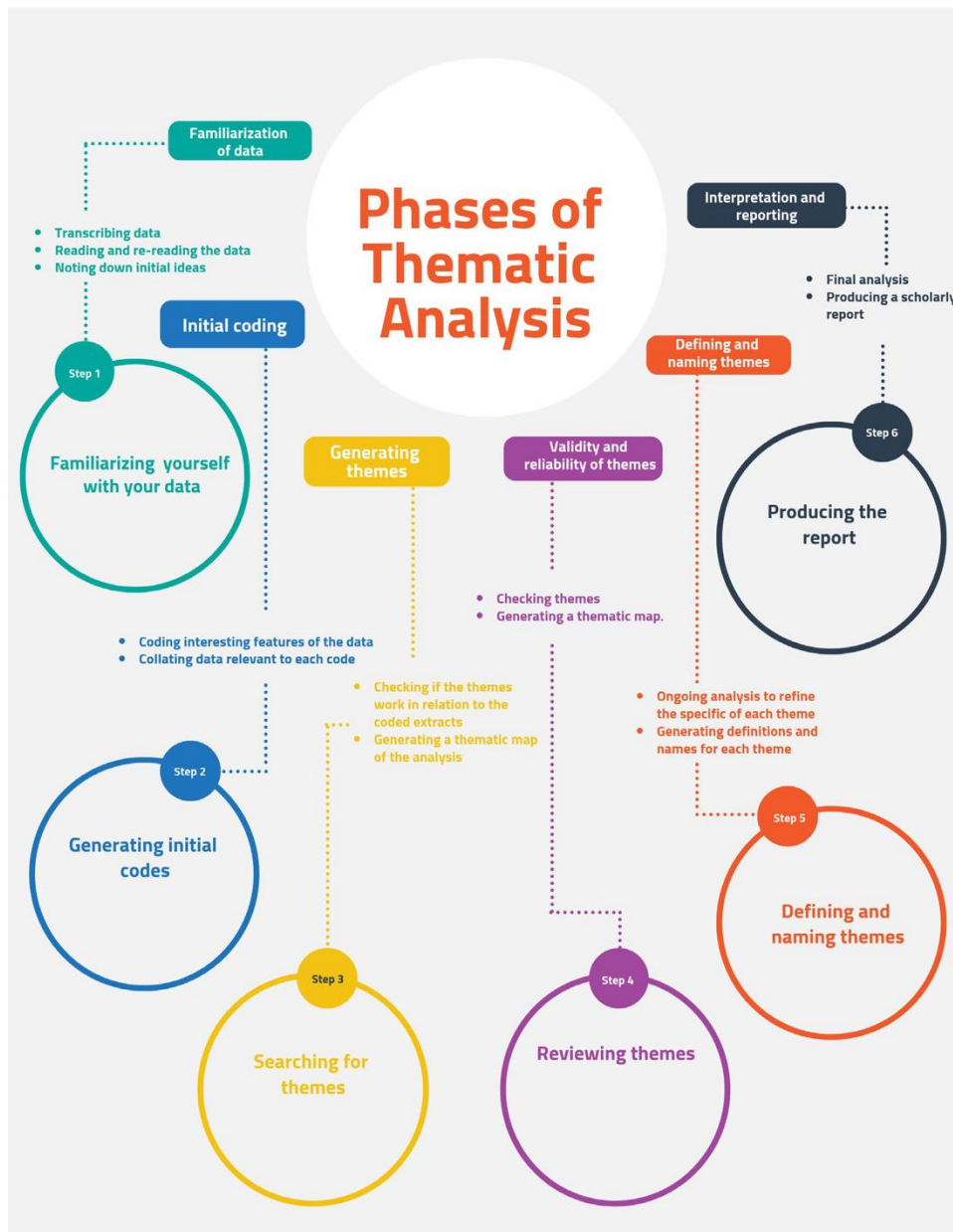


Figure 3.1 An illustration of Braun and Clarke’s thematic analysis approach for developing themes from qualitative data (adapted from Braun & Clarke, 2006, p 87).

Using the thematic analysis approach, the researcher is expected to transcribe the focus group discussion, and gain a better understanding through reading the transcriptions numerous times. When using thematic analysis, the researcher is primarily recommended to consider both manifest and latent content in data analysis. Gathering codes, open coding using possible themes and evaluating the emerging data together and concerning the overall information makes up the next phase of data analysis. Thematic analysis made use of a systematic

intervention in order to generate preliminary codes, significant themes and revising themes. The last phase of data analysis for this approach is reporting the findings from the previous phase. The researcher is expected to present findings in terms of a storyline for this approach.

Hsieh and Shannon (2005) affirm inductive analysis paired with thematic analysis can be used in research where there are no earlier studies dealing with the same aspects; therefore, all the coded themes stem directly from the text data. According to Thomas (2006), inductive analysis uses detailed raw data to create themes and concepts. The research question, framework for analysing and collecting data should help to select an approach. The research purpose, area of speciality and interest with suitable analysis methods help to select the choice between inductive or deductive approach. In this study, analysis of qualitative data will use an inductive approach. Vaismoradi et al. (2013) believe that this method of analysis is vigorous enough to be used when conducting an initial study, provided the researcher puts in ample energy and time on data collection and analysis of data.

3.10 Ethical Considerations

According to Mertens (2004), research planning and implementing must have an integral component of ethics. Similarly, Cohen et al. (2011) argue that non-maleficence, beneficence and human dignity should be fundamental principles. Non-maleficence is explained as not wanting to harm research participants and this is done by keeping participants' identities and feedback anonymous and confidential. Beneficence is explained by what benefits the research will bring to participants (Cohen et al., 2011). Similarly, Cohen et al. (2011, p.52) uses the term "Voluntarism" to explain how participants can apply the concept of informed consent, therefore allowing them to choose whether to participate or not in the research entirely on their own free will. Likewise, participants should also be able to withdraw at any time during the study without the fear of repercussions. However, Bell (2010, as cited in Cohen et al., 2011) contends that explaining the benefits of the research and getting informed consent early on is vital. Similarly, Cohen et al. (2011) argue that research intentions must be explained, and meaningful and credible reasons must be given in classrooms. Hence, learners have a legitimate reason not to take part. Bertrams and Christiansen (2014) explain this as autonomy where permission is required from every participant.

In this study, permission was obtained from the campus manager to inform them about this study (see Appendix 1), the purpose of this research and what this research required of them and the students. Then all students were given an informed consent letter to sign (see Appendix 2), which clearly outlined the aim and purpose of this action research, the data collection instruments and the duration of their involvement in the research process. The researcher kept all learners' names anonymous using pseudonyms to describe participants and their role. The researcher discussed all issues regarding confidentiality at the beginning when consent forms were given to participants. The researcher assured learners that all information discussed during the research process would remain confidential.

The positionality and power dynamics of this study could be questioned as I was the researcher and the lecturer to the participants. Since this was an action research study, I aimed to improve my teaching practice. To prevent any confusion between participants, I explained my positionality as a researcher and lecturer. It was explained to the participants that being the lecturer is my priority and there was no conflict as a researcher. They were made aware that my position as a lecturer would not be affected by my position as a researcher and it would not influence their learning. This intervention was only implemented after I taught the module as prescribed for the syllabus, thus if participants were not willing to take part in the study they were not disadvantaged. Merriam et al. (2001) argue that in a study, positionality and power dynamics are experienced by the researcher in both outsider and insider status. However, these moments were related to cultural values and norms of both the participants and researcher. Similarly, Narayan (1993, p.679) explains interactivity, knowledge and power as "To acknowledge particular and personal locations is to admit the limits of one's purview from these positions. It is also to undermine the notion of objectivity, because from particular locations all understanding becomes subjectively based and forged through interactions within fields of power relations."

Consent forms also explained to participants that their role in this research was voluntary and they could withdraw at any time during the research process. This would cover autonomy of the research that all participants could voluntarily consent to be in the study and could chose to withdraw at any time. I also explained to learners how this research could be a benefit to them since they would be exposed to a different approach or teaching strategies and how it could improve their understanding of the work. This covered beneficence where the research must benefit the learners. Exposing them to blended learning strategies while working with

practical components could be beneficial to the way they approach the module and subject after that.

3.11 Validity, Reliability and Rigour

By making critical questions in the questionnaire open ended and doing focus group discussions, this ensured the collection of rich qualitative data giving more insight to the learner's feelings and thinking, something one would not get from the other data collection tools. The rich qualitative data collected becomes thick description data. Bertram and Christiansen (2014) argue that unreliable data can be generated during the Hawthorne effect as the researcher's presence can cause participants to behave differently. Since I teach these students, they were familiar and comfortable with me and the environment. Being their lecturer helped to reduce the Hawthorne effect during observation. Similarly, Kawulich (2005, p. 4) argues "validity is stronger with the use of additional strategies used with observation, such as interviewing, document analysis, or surveys, questionnaires, or more quantitative methods." In this research study, I collected data using an observation schedule, a questionnaire with open and close-ended questions and focus group discussions. The data collected from each source was checked for contradictions or confirmability, therefore improving triangulation. No names were required in the questionnaire to ensure participants were honest and gave reliable data in the questionnaire. As a result, students were encouraged to write honestly and freely without fear of retribution. Lastly all figures and calculations of data analysis were also checked by a colleague to confirm all data and ensure reliability. All learners' anonymity and confidentiality were ensured to protect their identities. Lastly, explaining the limitations of this research upfront also improved its trustworthiness. By undertaking all these measures to ensure credibility, it also improved the dependability of the study.

Golafshani (2003) argues that reliability and validity may have their foundations from a positivist institution but when used in qualitative studies, it does not have the same meaning. This is due to qualitative research using naturalistic methods to prompt findings in real world contexts while gaining insight of events in their context instead of universal overviews. Patton (2002, p.14) believes that when doing qualitative studies, the "researcher is the instrument", meaning that the researcher is part of the context being studied. According to Jugoo (2014, p.57) "The idea of reliability in qualitative research is about deriving an understanding of the

phenomenon and the term trustworthiness is substituted for validity in qualitative studies, which refers to establishing confidence in the data that is elicited in the study.” Patton (2002) maintains that using triangulation procedures, that is, combining and using numerous methods to collect data and methods of research can result in improved trustworthiness. This research engaged in using multiple methods to collect data.

In qualitative studies, trustworthiness is of vital importance especially in an action research study. According to Rule and John (2011, p.107) trustworthiness encourages “scholarly rigour, transparency and professional ethics”. Similarly, Lincoln and Guba affirm trustworthiness is a necessity for researchers to endorse the research findings so that others see it as high quality and worth referring (1990, as cited in Maree, 2007). Achieving trustworthiness when using a critical paradigm can be accomplished by strengthening self-reflexivity, credibility, confirmability, construct validity, dependability and transferability.

3.12 Conclusion

The research design and methodology were described in this chapter. Firstly, the critical research paradigm and the ontological and epistemological assumptions of the critical research paradigm were discussed. Next, the use of action research as the research design and suitability for this study is explained. An overview of the four steps of action research for the two cycles are explained. Convenience and purposive sampling strategies are described. Data generation instruments namely, questionnaires, focus group discussions, observation and surveys are outlined. The process of thematic, inductive analysis is then explained. The chapter concludes with a discussion of ethical issues and trustworthiness. The next chapter focuses on presentation and analysis of data.

CHAPTER 4 - DATA PRESENTATION AND ANALYSIS

4.1 Introduction

The purpose of this study was to examine the use of blended learning using the flipped classroom approach to enhance student learning and understanding in Electronic Control and Digital Electronics at a TVET College. The previous chapter summarised the methodological approach of action research adopted in this study, to address the research question. The focus of this chapter is on the data presentation and data analysis using Garrison and Vaughan's Community of Inquiry theoretical framework.

This chapter presents the results from both the quantitative and the qualitative data generation instruments. A questionnaire, observation checklist and survey were the instruments that were used to generate the quantitative data while the survey and a focus group discussion served as data generation instruments for the qualitative data. The research question that guided this study and the analysis was:

To what extent does blended learning and a flipped-classroom approach enhance students learning in basic electronic tools and measuring equipment in Electronic Control and Digital Electronics Level 2 at a TVET College?

Data was generated using four data collection instruments: questionnaire, observation checklist, survey and focus group discussion. The questionnaire and observation checklist were used for collecting data in both cycles, whereas the survey and focus group discussion was used once at the end of cycle two. Data is presented and analysed according to data generation instruments. Firstly, data from the questionnaire is presented and analysed, followed by the observation checklists and then the survey. The chapter concludes by presenting and analysing data from the focus group discussion. The responses of participants are written in italics throughout this chapter.

Inductive methods of analysis were used to analyse and interpret the responses of the participants. This was done to allow the data to reveal the themes arising from the codes. Themes and analysis were then aligned to the Community of Inquiry framework and relevant literature. The following section presents and analyses the data from the questionnaire.

4.2 Questionnaire

The questionnaire consisted of ten questions and made use of a Likert scale. The five options available to learners to choose from were strongly disagree, disagree, neither agree/disagree, agree, and strongly agree. Quantitative data from the questionnaire was analysed using descriptive statistics and is represented using graphs and percentage values. Below are the graphs representing the data analysis of the questionnaire. The vertical X axis represents the percentage value and the Y axis represents each question.

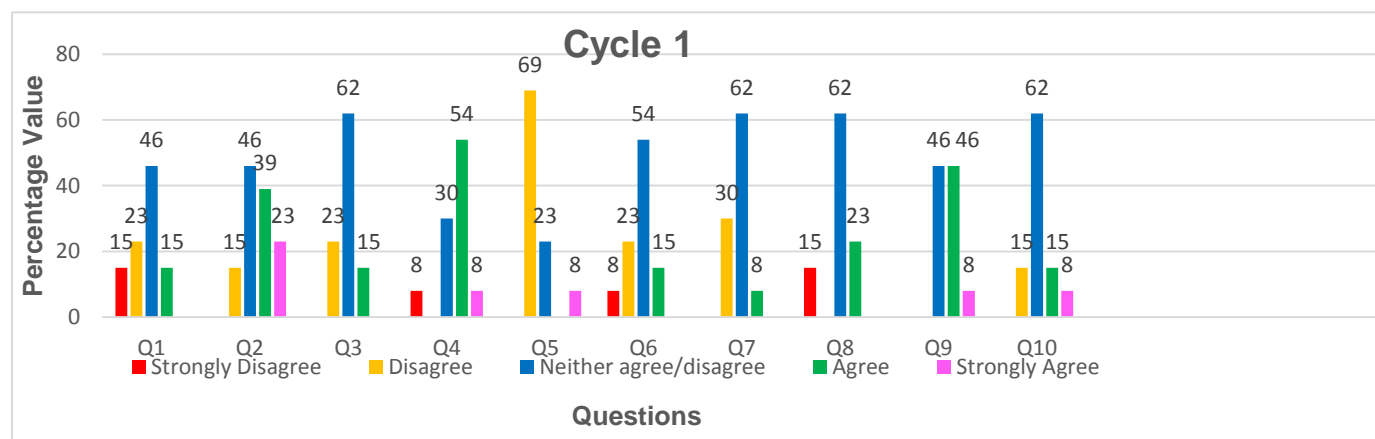


Figure 4.2 Bar graph for Questionnaire cycle 1

In Figure 4.1 the ten questions from the questionnaire in cycle one is presented. For question 1, the flipped classroom is more engaging than traditional classroom instruction, participants responses were: 0% strongly disagree, 15% disagree, 46 % neither agree/disagree, 15% agree and 0% strongly agree. This suggests that the largest percentage (46%) of learners were unsure about using this strategy. Question 1 links with the theoretical framework through the teaching and cognitive presence. The teaching presence caters for the setting of curriculum and methods and applying new ideas. The cognitive presence makes use of having a sense of puzzlement and connecting ideas in this question.

For question 2, the flipped classroom increased my communication with others in the class, participants responses were: 0% strongly disagree, 15% disagree, 46 % neither agree/disagree, 39% agree and 23% strongly agree. The highest percentage (46%) of learners were unsure about their communication being increased during this strategy implementation. Question 2 links the framework through the social presence. Increased communication leads to enabling risk-free expression, encouraging collaboration, expressing emotions and having camaraderie.

Participants showed this when working with others and the lecturer by making use of the WhatsApp platform and face-to-face lessons.

For question 3, I am more motivated to learn ECDE in a flipped classroom, participants responses were: 0% strongly disagree, 23% disagree, 62% neither agree/disagree, 15% agree and 0% strongly agree. The highest percentage (62%) of learners were unsure whether the flipped classroom strategy motivated them to learn. The teaching presence and cognitive presence is associated with question 3. Sharing personal meaning and focussing discussion (teaching presence) while connecting ideas (cognitive presence).

For question 4, I prefer watching lessons on videos, participants responses were: 8% strongly disagree, 0% disagree, 30% neither agree/disagree, 54% agree and 8% strongly agree. The largest percentage of learners (54%) preferred watching lessons on videos. The teaching and cognitive presence are related to this question. Setting curriculum and applying new ideas (teaching presence) while exchanging information and connecting ideas (cognitive presence) are the descriptions linking to the framework.

For question 5, I find it easy to pace myself through the work, participants responses were: 0% strongly disagree, 69% disagree, 23% neither agree/disagree, 0% agree and 8% strongly agree. This suggests that participants struggled with the pacing and freedom to work on their own diligently as the greatest percentage (69%) disagreed with this question. This question is linked to the teaching and cognitive presence. Applying new ideas, sharing personal meaning and focusing discussion are the descriptions related to the teaching presence. Connecting ideas and exchanging information can be linked to the cognitive presence.

For question 6, the flipped classroom would be useful in my other subjects in this course, participants responses were: 8% strongly disagree, 23% disagree, 54% neither agree/disagree, 15% agree and 0% strongly agree. In this question, learners once again showed their uncertainty as the highest percentage value (54%) responded neither agree/disagree. The social presence is evident by enabling risk free expression and to apply themselves in other subjects. The teaching presence is linked to applying new ideas and sharing personal meaning to answer this question.

For question 7, the flipped classroom has improved my learning and understanding of this module, participants responses were: 0% strongly disagree, 30% disagree, 62% neither agree/disagree? 8% agree and 0% strongly agree. The uncertain feelings and understanding of using this strategy are once again shown by the highest percentage of learners (62%) responding neither agree/disagree. Sharing personal meaning and focusing discussion which is part of the teaching presence is linked to this question. Also connecting ideas and exchanging information (cognitive presence) is also related to this question.

For question 8, there were more benefits of using the flipped classroom in this module, participants responses were: 15% strongly disagree, 0% disagree, 62% neither agree/disagree, 23% agree and 0% strongly agree. The highest percentage (62%) of learners responded neither agree/disagree showing participant uncertainty. All three presences could be used to analyse this question. The social presence describes enabling risk free expression; the cognitive presence has connecting ideas while the teaching presence has sharing personal meaning.

For question 9, there were more challenges using the flipped classroom, participants responses were: 0% strongly disagree, 0% disagree, 46% neither agree/disagree, 46% agree and 8% strongly agree. Similarly, question nine contains all three presences just like question eight. This question had a tie of 46% for two categories; neither agree/disagree and agree. Participants expressed their concern in this question showing that there were lots of challenges they faced. The social presence is linked to enabling risk free expression; the cognitive presence has connecting ideas while the teaching presence has sharing personal meaning.

For question 10, I have a greater chance of passing this module because of the flipped classroom, participants responses were: 0% strongly disagree, 15% disagree, 62% neither agree/disagree, 15% agree and 8% strongly agree. This question once again showed participant vulnerability and their doubt since the highest percentage response (62%) was neither agree/disagree. This question is linked to the social presence as enabling risk free expression is applicable. The teaching presence uses sharing personal meaning and applying new ideas. Lastly, the cognitive presence uses connecting ideas and exchanging information.

The results from the questionnaire highlight learners doubt and uncertainty about using the flipped classroom strategy. This was evident in the highest percentage in the neither agree/disagree category (represented in blue in Figure 4.1) for eight out of the ten questions.

Likewise, nine out of the ten questions showed more negative feedback from learners. However, only question 4 showed positive feedback and participants agreed with the question. Question nine was a concern as 92% of feedback was negative since most learners agreed that there were more challenges when using the flipped classroom strategy in cycle one. From the data in the graph, and participants' responses to majority of the questions, it is evident that learners were undecided about this new flipped classroom strategy and whether it would benefit their learning.

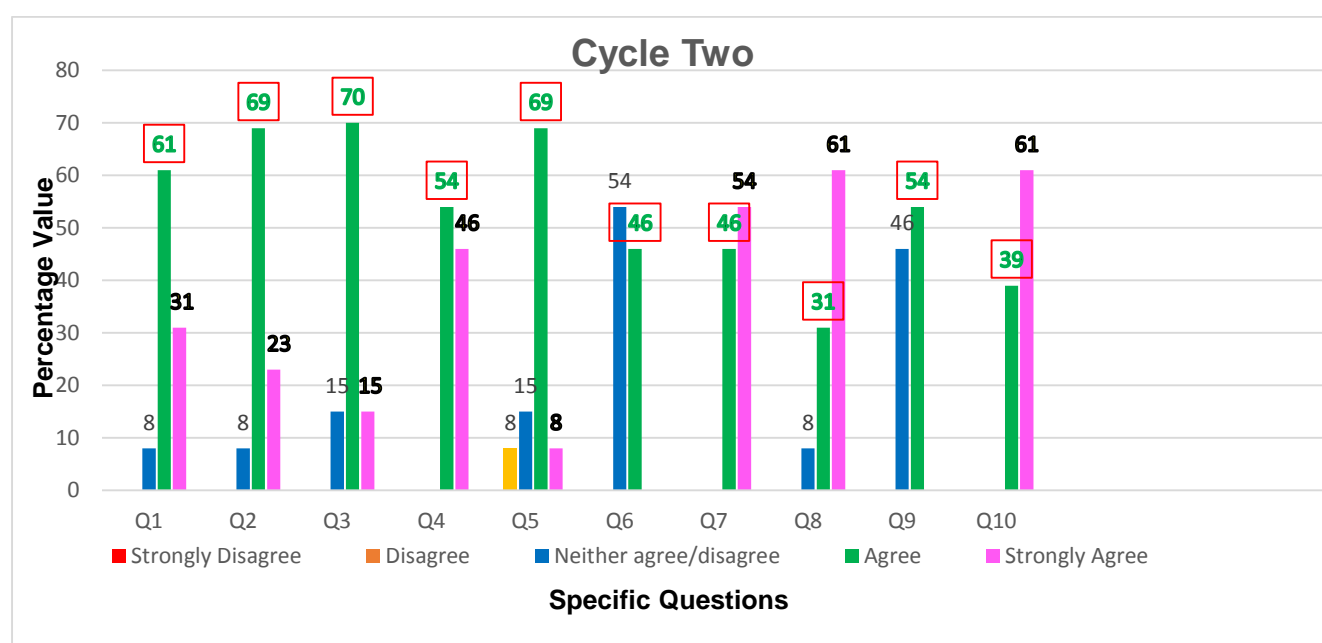


Figure 4.2 Bar graph for Questionnaire cycle two

Figure 4.2 presents the data from the questionnaire in cycle two. For question 1, the flipped classroom is more engaging than traditional classroom instruction, participants responses were: 0% strongly disagree, 0% disagree, 8% neither agree/disagree, 61% agree and 31% strongly agree. The feedback in cycle 2 improved for this question. Participant responses were positive for this question. The highest percentage of learners 61% responded agree and 31% of learners responded strongly agree. Therefore, 92% of the responses were positive for question 1.

For question 2, the flipped classroom increased my communication with others in the class, participants responses were: 0% strongly disagree, 0% disagree, 8% neither agree/disagree, 69% agree and 23% strongly agree. The strongly agree and agree categories received 92% of the responses showing a positive outlook for participants.

For question 3, I am more motivated to learn ECDE in a flipped classroom, participants responses were: 0% strongly disagree, 0% disagree, 15% neither agree/disagree, 70% agree and 15% strongly agree. This question showed a positive response from learners as the strongly agree and agree categories received 85% feedback.

For question 4, I prefer watching lessons on videos, participants responses were: 0% strongly disagree, 0% disagree, 0% neither agree/disagree, 54% agree and 46% strongly agree. While this question was positive in the first cycle, it improved significantly in cycle two. The agree and strongly agree categories received 100% of the responses.

For question 5, I find it easy to pace myself through the work, participants responses were: 0% strongly disagree, 8% disagree, 15% neither agree/disagree, 69% agree and 8% strongly agree. This question also shows a positive outlook as 77% of learners responded with agree and strongly agree categories.

For question 6, the flipped classroom would be useful in my other subjects in this course, participants responses were: 0% strongly disagree, 0% disagree, 54% neither agree/disagree, 46% agree and 0% strongly agree. While there was an increase in the agree column to this strategy being useful in participants other subjects. The majority of participants still showed uncertainty as neither agree/disagree received 54% feedback.

For question 7, the flipped classroom has improved my learning and understanding of this module, participants responses were: 0% strongly disagree, 0% disagree, 0% neither agree/disagree, 46% agree and 54% strongly agree. All participants agreed that this strategy helped them to learn better and understand this module. Agree and strongly agree categories covered 100% of the feedback.

For question 8, there were more benefits of using the flipped classroom in this module, participants responses were: 0% strongly disagree, 0% disagree, 8% neither agree/disagree, 31% agree and 61% strongly agree. This question also showed a positive response as 92% of the feedback was in agree and strongly agree categories.

For question 9, there were more challenges using the flipped classroom, participants responses were: 0% strongly disagree, 0% disagree, 46% neither agree/disagree, 54% agree and 0%

strongly agree. This question showed a more negative inclination. 46% of participants were unsure how to answer this question, however 54% agreed that there were lots of difficulties associated with the flipped classroom strategy.

For question 10, I have a greater chance of passing this module because of the flipped classroom, participants responses were: 0% strongly disagree, 0% disagree, 0% neither agree/disagree, 39% agree and 61% strongly agree. All of the feedback was positive with 61% of the participants responding strongly agree which highlighted the success of this cycle.

At the end of cycle one, learners provided feedback about changes that should be implemented to improve the teaching strategy in cycle two. This was important as it is a key element of blended and flipped learning strategies, which showed that participants were more involved and took control of their own learning. Data indicated that participants provided much more positive feedback in cycle two. Unlike in cycle one, data in cycle two showed a considerable change in participant's responses. For the majority of questions, learners provided positive feedback and either agreed or strongly agreed. In questions 1, 2, 3, etc. the agree category received the highest percentage value while in questions 4, 5 etc. The highest percentage values were in the strongly agree category. However, question 6 still showed participants' uncertainty as the neither agree/disagree category received the highest percentage value. Questions 6 and 9 were still a concern in cycle two. In question 6, 54% of feedback was neither agree/disagree while in question 9, the majority of the learners, 54%, agreed that they still had more challenges using this approach and the other 46% answered neither agree/disagree. A significant change in the data between the two cycles was in question 10, where all learners agreed (39%) and strongly agreed (61%) that they had a greater chance of passing this module which was a significant improvement compared to the 23% of learners in cycle one.

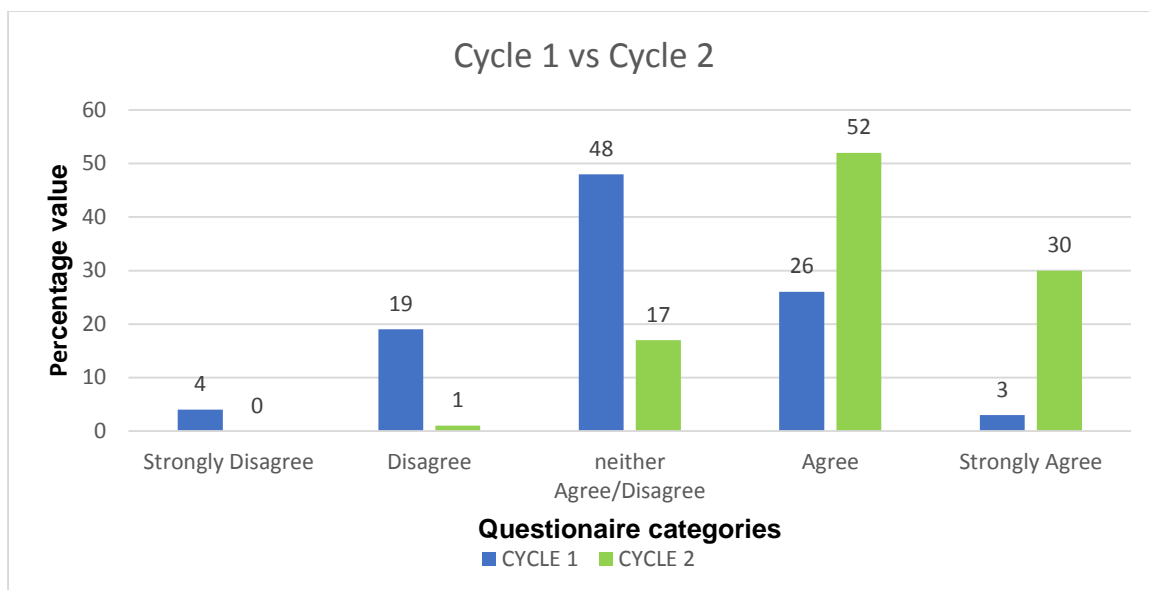


Figure 4.3 Bar graph showing Questionnaire comparison of both cycles

In the above graph (Figure 4.3), the percentage of answers for each category of the questionnaire in cycle one is compared to cycle two. As presented in the graph, cycle one, represented in blue, had the majority of the strongly disagree, disagree, and neither agree/disagree categories. Cycle one analysis suggests that learners were negative and unsure about the flipped classroom strategy and whether it would help to improve their learning and understanding. However, in cycle two, represented in green on the bar graph in Figure 4.3, there was a significant shift in the responses moving towards the agree and strongly agree categories. Also, there was a considerable decrease from 48% to 17%, in the category neither agree/disagree. This indicated that learners were much more positive and certain about their outcomes when using this strategy in cycle two.

The analysis of data of the questionnaires supports findings of other studies and literature on blended learning when using the flipped classroom approach in an action research (Garrison & Vaughan, 2008; Graham, 2006; Bliuc et al., 2012). The data analysis of cycle one clearly shows a negative view of this strategy as learners were still grasping the concept of this new approach and did not buy into this new teaching strategy which also supports the findings and views of numerous literature and researchers (Sahin, 2010; Kenney & Newcombe, 2011; Hughes, 2007). However, the analysis and findings in the questionnaire contradict the findings of other literature (Rovai, & Jordan, 2004; Graham & Allen, 2005; Heinze, 2008). Rovai and Jordan (2004) argue that if sufficient ground work is done prior to the study and the researcher has

some knowledge of the participants, then positive feedback can be achieved from as early as the first cycle. However, Heinze (2008) explains the minimum timeframe needed for the first cycle should be at least three weeks, in contrast to this study which was one week. On the other hand, cycle two showed vast improvement as learners bought into the flipped classroom strategy and understood how to use the online platforms better. The data analysis in this study also supports the findings of other studies and literature (Bergmann et al., 2011; Gallagher, 2009); however, the findings were contradictory to other researchers (Overmyer, 2012; Cole & Kritzer, 2009; Gannod, Berg & Helmick, 2008). Overmyer (2012) argues that positive feedback is usually seen after two cycles while this study showed positive feedback after the first cycle. Cole (2009) and Gannod et al. (2008) explain in their studies that data from questionnaire should be qualitative and emphasis should be on the feelings and emotions of the participants during data collection. The questionnaire in this study, however, focused on quantitative aspects to collect meaningful data to show positives and improvement during the research. The following section presents and analyses data generated from the observation checklist.

4.3 Observation Checklist

The data collected from the observation tool was analysed and represented in pie charts and graphs with percentage values. The observation schedule was used in both cycles and each tool's criteria are compared next to each other in graph form for analysis purposes. The pie charts below (see Figure 4.4 and Figure 4.5) show participants' overall outcomes for the observation schedule in cycles one and two.

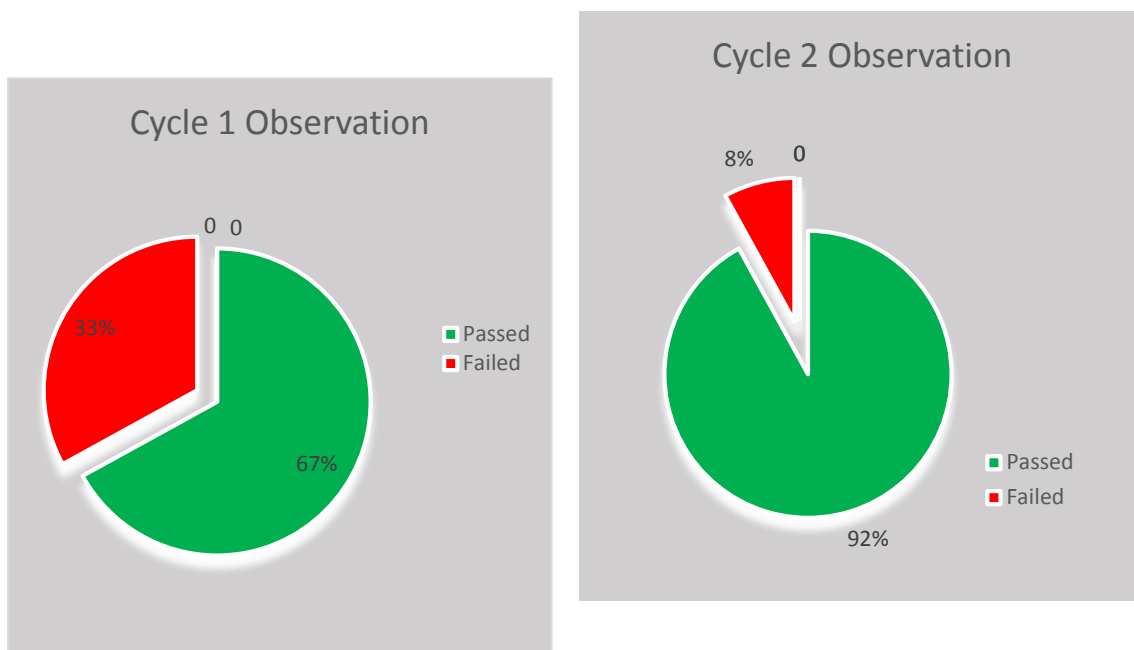


Figure 4.4 Observation pass rate Cycle 1 & Observation pass rate Cycle 2

The observation schedule used during practical assessment in workshops is a DHET official document, with 50% required to pass. Out of the twelve learners participating, eight achieved a pass while four received below the recommended pass mark of 50%. In cycle one, the green 67% shows the learners who achieved a pass while the red 33% indicates the number of learners who did achieve competence in the observation assessment. In cycle two of the twelve learners participating, only one did not achieve a pass. This resulted in a 92% pass and an 8% failure rate.

From the pie charts in Figure 4.4 above, it is evident that there was an improvement in learner performance from cycle one compared to cycle two. Cycle two showed an increased improvement of 25% in the passing of the observation schedule.

Students were assessed by four categories for each question, Outstanding which scored four marks; highly competent, which scored three marks, competent which scored two marks or Not Achieved, which scored zero to one mark (see Appendix 4). The graphs (Figures 4.5 to 4.9) illustrate what percentage of students achieved for each category for each question during the observation. As with this TVET College and campus policy, a Not Achieved percentage of 20% and higher would become focus areas to improve before students attempt their final

assessments. The following graphs (see Figures 4.5 to 4.9) show how each question was scored during each cycle's observation process.

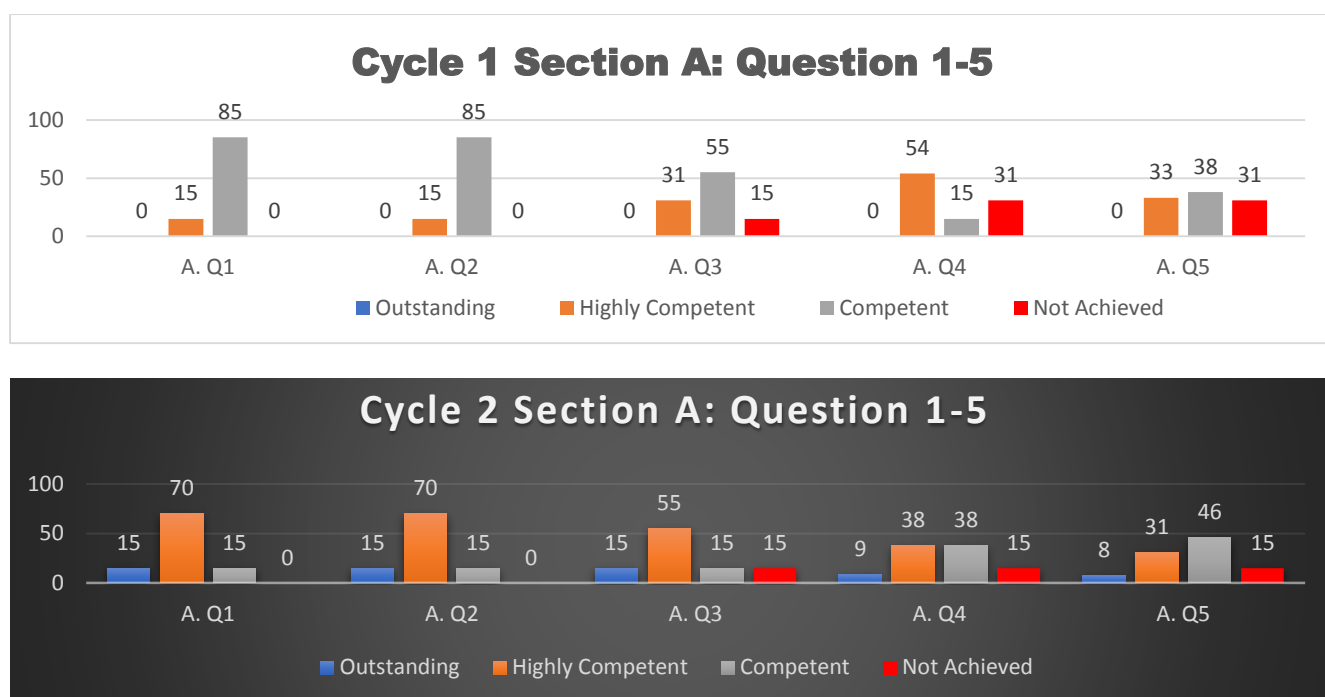


Figure 4.5 Section (A) Selection and use of tools: Questions 1-5

Figure 4.6 represents the selection and use of tools section for observation in both cycles. Question 1 focussed on the selection of electronic tools, question 2 was related to the use of electronic tools, question three examined housekeeping, question four was related to selection of measuring equipment and question five focused on the use of hand measuring equipment.

In Section A, two of the three cognitive descriptions could be used to analyse the observations. Learners displayed a sense of puzzlement and connecting ideas when trying to understand this new online learning strategy and applying it to the workshop environment. Learners were offered an assortment of options for modifying their learning practice based on their individual needs and inclinations in the workshop. This allowed for a learner-centred approach in a vocational environment which can improve cognitive levels. Connecting ideas was evident when learners remembered the videos and applied it to the workshop tasks, merged it with their syllabus to apply it to the strategy and to continue with their learning at a time and location of their choosing.

In cycle one, only questions 4 and 5 were areas of concern as both questions achieved 31% for the ‘not achieved’ category. However, while the ‘not achieved’ category in questions 1, 2 and 3 did not receive 20% and higher, these questions did not show participants doing well in this section. Questions 1, 2 and 3 accomplished the highest percentage value in the competent category showing that participants just managed to pass. An overall assessment of cycle one shows participants’ achievement was below average.

However, there was an improvement in cycle two, and no questions had 20% and higher in the ‘not achieved’ category. Similarly, in all questions in cycle two there were increases in the ‘outstanding’ category. Likewise, questions 1, 2, and 3 demonstrated increases in the ‘highly competent’ category in cycle two. This represents a vast improvement from cycle one and suggests that participants adjusted and gained a better understanding of the new strategy. An overall assessment of cycle two shows that participants’ achievement was well above average.

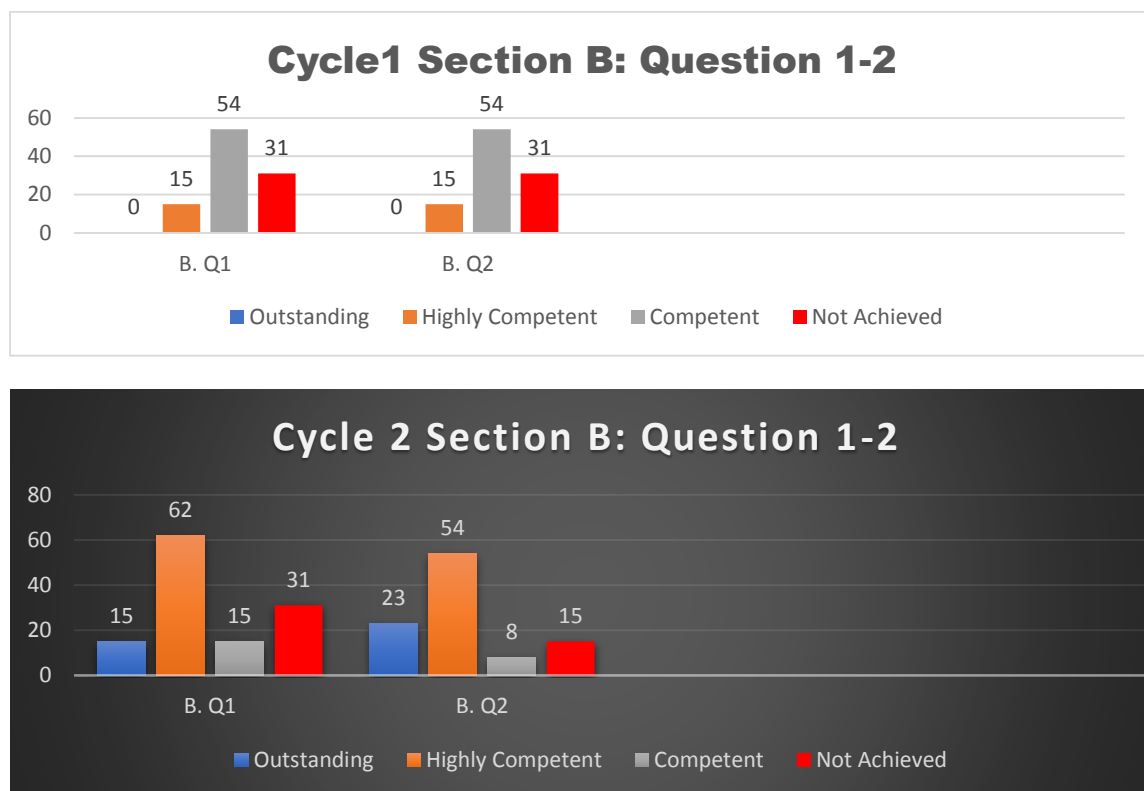


Figure 4.6 Section (B) Identification of components and materials: Questions 1-2

Figure 4.6 represents the identification of components and materials during observation. Question one was related to the identification of electronic components and question two examined the identification of materials as per diagram.

Section B can be explained with the cognitive presence as learners applied new ideas, connected new ideas, and exchanged information. It is evident that participants were responsible for their learning in this section. They had to take responsibility for their learning. As a result, learners learned more about themselves and what they could and could not do in the workshop environment. Many of the participants explained how they learned to focus, work independently, be self-independent with their practical tasks. These represented traits of cognitive improvement and learner development. Learners collaborated with participants in the workshop, which demonstrated critical thinking and self-development.

In cycle one, both questions 1 and 2 were a concern as both received over 30% respectively in the 'not achieved' category. Both questions also obtained the highest percentage in the 'competent' category with participants barely achieving a pass. An overall assessment of cycle one showed that participants' achievement was below average.

However, cycle two showed an improvement with vast increases in the 'highly competent' category and both questions receiving percentage values in the 'outstanding' category. In spite of this improvement, question 1 will need more probing as participants' responses were above 30% in the 'not achieved' category in cycle two. An overall assessment of cycle two showed that participants' achievement was well above average.

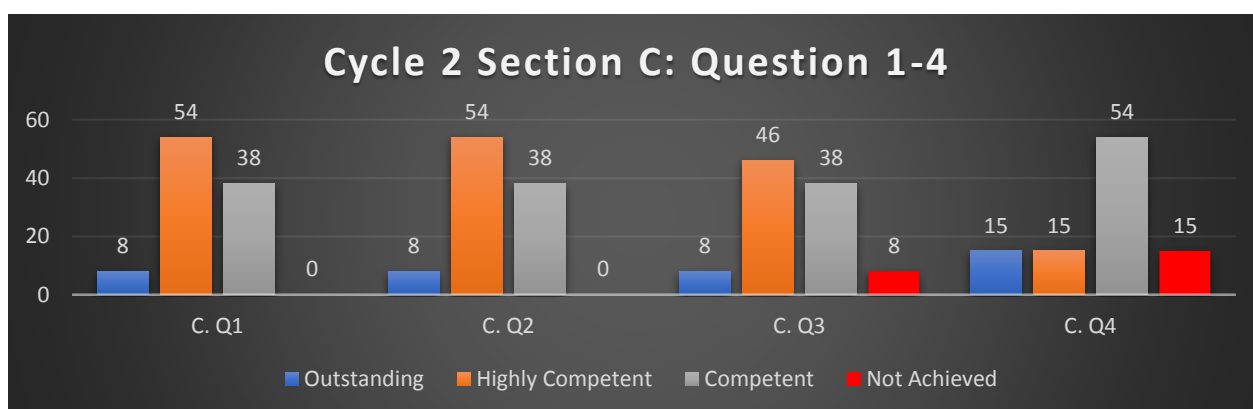
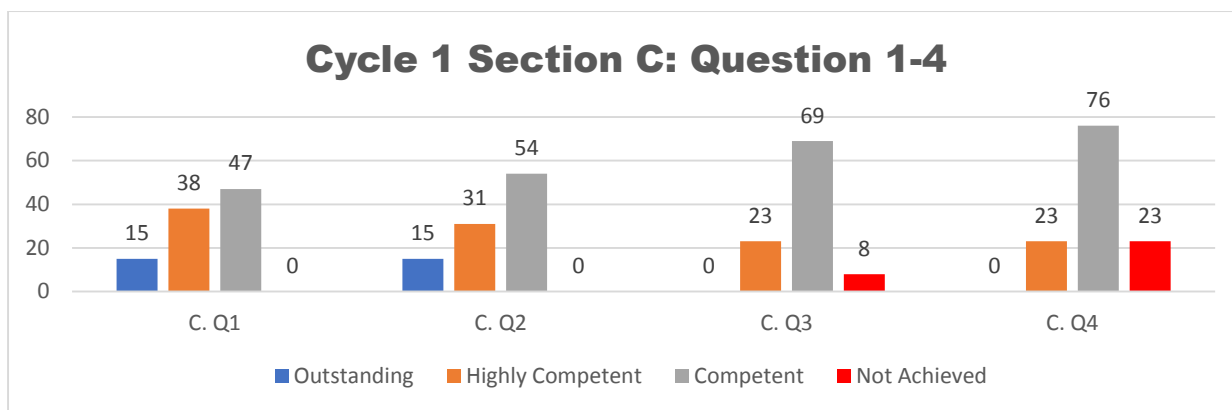


Figure 4.7 Section (C) Arranging components on planning sheet: Questions 1-4

Figure 4.7, represents the observation involved arranging components on the planning sheet. Question 1 examined as per circuit diagram, question 2 was related to the planning, question 3 focused on short circuits and question 4 dealt with component polarity.

It was the first time learners had to build a circuit being taught a different strategy compared to their previous module. As a result, learners showed a sense of puzzlement with how to arrange and plan circuits and components while applying a new strategy with new resources. Connecting ideas and exchanging information could also represent learners coming up with solutions and thinking out of the box and working together to overcome this challenge. Working together also inadvertently could be linked to the social presence.

In cycle one, question 4 was the only concern as 21% of learners did not achieve competence with understanding component polarity. Questions 1, 2, 3 and 4 achieved 47%, 54%, 69% and 76% respectively as highest percentage values for the 'competent' category. Participants achieved better outcomes in questions 1 and 2 with both questions achieving over 45% combined in the 'outstanding' and 'highly competent' category. An overall assessment of cycle one showed that participants' achievement was below average.

In cycle two, there were positive developments as no questions scored above 20% in the ‘not achieved’ category. Another positive marker was the percentage shift of learners from the ‘competent’ to ‘highly competent’ category in questions 1, 2, and 3. However, question 4 still achieved a high percentage of 54% in the ‘competent’ category and will need further probing. Participants’ achievement was well above average for this question in cycle two.

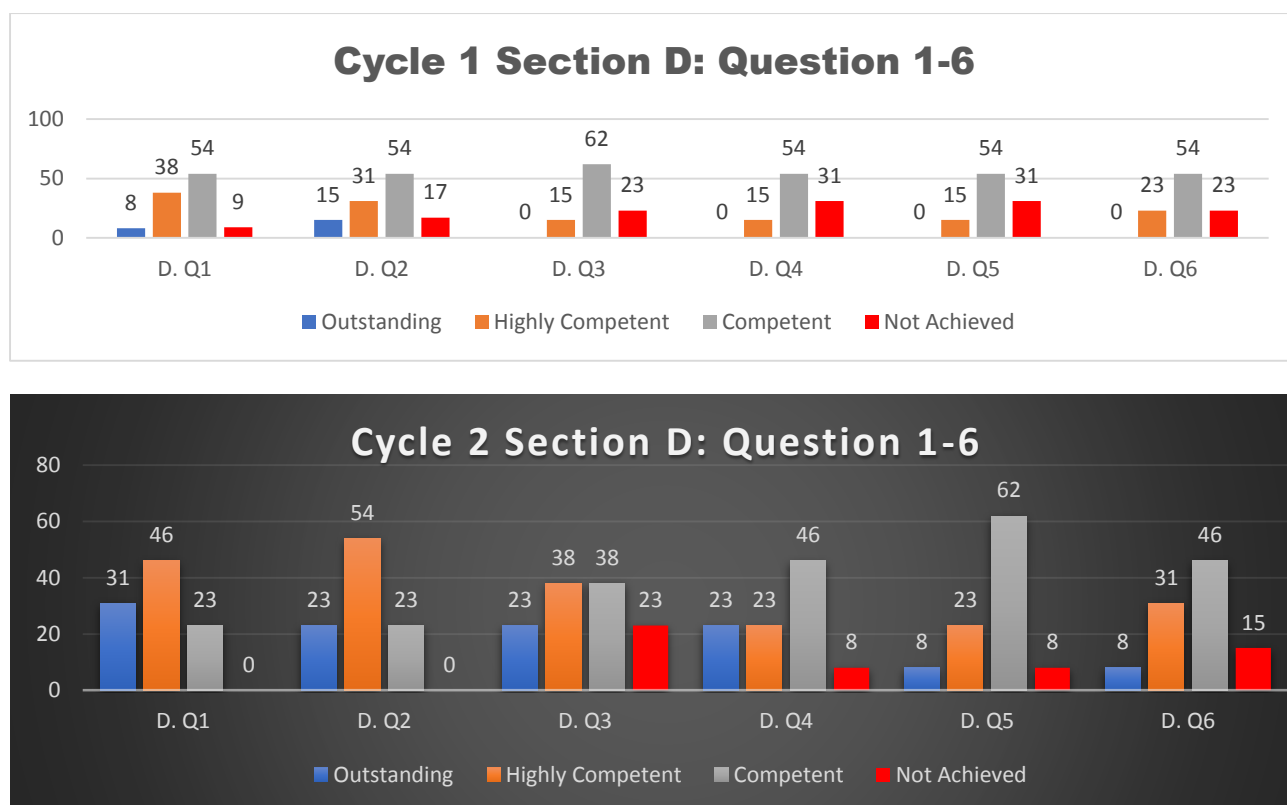


Figure 4.8 Section (D) Implementation and layout of components: Questions 1-6

Figure 4.8, represents section D deals with the implementation and layout of components. Question 1 examined the arrangement of components on breadboard, question 2 focused on laying of components on breadboard, question 3 dealt with observation of polarity, question 4 focussed on the bending of components, question 5 dealt with soldering and question 6 focused on the trimming of leads.

It was evident that learners applied new ideas, set curriculum, and focused discussion which could be linked to the teaching presence. The participants had to plan how to deliver in the workshop environment after watching lessons online. The Covid-19 pandemic shortened

workshop time which resulted in participants having a sense of puzzlement and connecting ideas which are traits of the cognitive presence. The curriculum in the shortened time frame improved collaboration between participants and demonstrated the social presence.

In this section for cycle one, participants fared the worst. Participants achieved more than 20% in four out of the six questions. Questions 3, 4, 5, and 6 were the main areas of concern for cycle one. All six questions achieved the highest percentage values for the competent category. Results for this section were highly negative as majority of the feedback was found in the ‘not achieved’ and ‘competent’ categories. Achievements of participants in this section were well below average.

However, cycle two in this section showed the most improvement by participants. Only question 3 scored a 23% rating in the ‘not achieved’ category. All questions from 1 to 6 had increased in the ‘outstanding’ and ‘highly competent’ categories when compared to cycle one, while questions 1 and 2 achieved 0% in the ‘not achieved’ category in cycle two. Questions 4 and 5 also highlighted a 23% reduction in the ‘not achieved’ category in cycle two. Achievements of participants were well above the norm in this question.

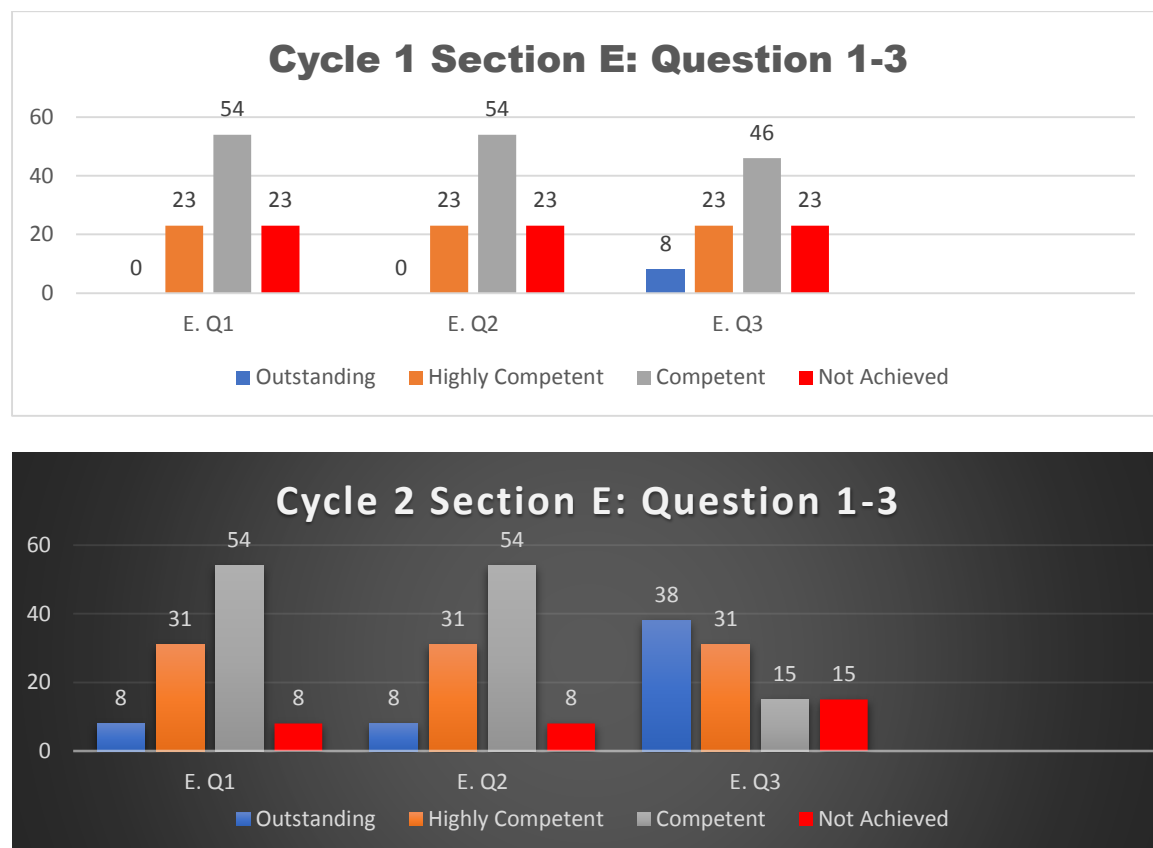


Figure 4.9 Section (E) Overall impression of completed task: Questions 1-3

The final section E for Figure 4.9, examined the overall impression of completed tasks.

Question 1 covered functionality of task, question 2 focused on presentation of task and question 3 was related to collaboration with peers.

This section showed traits of all three presences. The teaching presence involved applying new ideas and sharing personal meaning. Participants had to think out of the box to finish this assessment with all the regulations put in place due to the pandemic. This linked up with the cognitive presence with participants connecting ideas and exchanging information. The exchanging of information between participants and camaraderie led to greater collaboration which is related to the social presence.

All questions achieved 23% for category 'Not Achieved' in cycle one. The 'competent' category for all three questions achieved the highest percentage values. All three questions achieved 23% in the 'highly competent' category. Achievements of participants were noted as average. Cycle two demonstrated improvements by participants as no question scored 20% and higher for the 'not achieved' category. Cycle two also produced increases in the 'outstanding' and 'highly competent' category for all three questions. Question 3 achieved the highest percentage value for dealing with collaboration. Achievements of participants in cycle two were well above average for this section.

From an overall assessment, cycle two could be considered more successful from the data obtained. From the overall twenty questions found in the observation, only two scored 20% and higher for the 'not achieved' category compared to the twelve found in cycle one. Data from observation cycle two seemed to support the questionnaire's data, which showed that cycle two resulted in improved learners' understanding of the module. The data analysis in the observation supports literature and findings for action research by Bergmann (2011) which shows learner progress improves drastically with more cycles being used, while blended learning by Gallagher (2009), Cole and Kritzer (2009) and Overmyer (2012) explain how learner centred education improves with the use and flipped classroom approach. The following section presents and analyses data generated from the survey.

4.4 Survey

This section presents and analyses data from the survey. The survey was done after the second observation and consisted of 25 questions. Questions 1 to 20 were closed-ended (see Appendix

5), and learners had three options to choose from, yes, no, and sometimes. This allowed the researcher to immediately identify specific problems participants faced affecting learning and teaching outcomes. The remaining five questions were open-ended, and learners were encouraged to write the positive and negative experiences they faced with the new flipped classroom strategy.

The five open-ended questions were analysed using an inductive approach and thematic analysis. Each of the open-ended questions were analysed individually; with codes derived for each question. These codes were further analysed using thematic analysis, resulting in three themes emerging for questions 21 – 25. The survey was used so its data analysis could be used to triangulate data generated from the questionnaire and observation schedule. The survey was also used to help identify any discrepancies between the data collection tools. The graphs below show the percentage value of how the students answered each question in the survey.

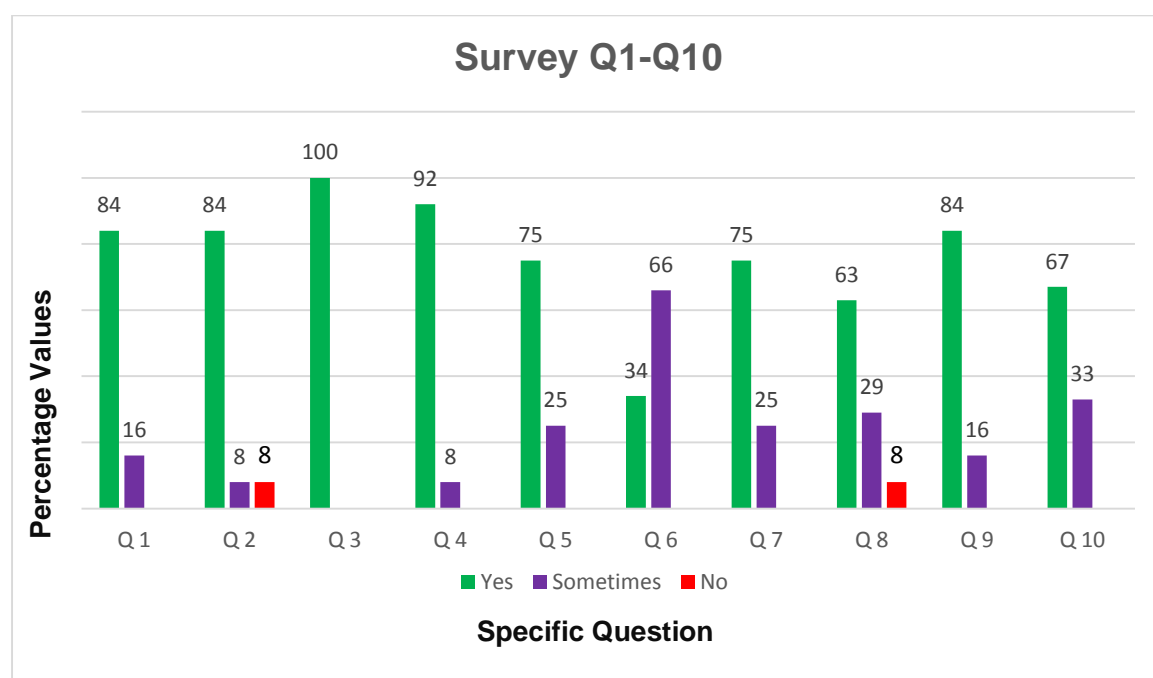


Figure 4.10 Bar graph of Survey Q1-Q10

Questions 1 to 20 were designed to get specific feedback from participants, which were used to identify the challenges and areas of difficulties that arose during the study. The community of inquiry framework was used when designing these questions, to cater for the teaching, social and cognitive presence and was used to analyse the data and interpret the findings.

Question 1, 5, 7, 10 and 12 can be linked to the teaching presence. The questions covered aspects of setting curriculum and methods, sharing personal meaning, focusing discussion and applying new ideas. Applying new ideas and setting a curriculum aimed at obtaining feedback from learners on how well the researcher applied the new strategy while merging it into the curriculum and practical program. Sharing personal meaning could be related to the researcher's self-development while using this strategy.

Questions 4, 11 and questions 13 to 18 could be analysed using cognitive presence. Participants demonstrated having a sense of puzzlement, exchanging information and connecting ideas during this study. All three presences were experienced by participants. Learners were not sure what to make of the new flipped classroom strategy and how to get the best out of it, which resulted in the sense of confusion. There was an improvement in the second cycle improvement, which showed that participants were connecting ideas and exchanging information to overcome the challenges.

The social presence was not put into a specific question but rather found in questions either combining with the teaching or cognitive presence. The teaching and social presence combination can be associated with questions 2, 3, 6, 8, 9 and 19. Question 20 is the only question that had a social and cognitive combination. While the cognitive and teaching presence is similar to the explanations in the above paragraphs, the social presence had enabling risk-free expression, encouraging collaboration. While collaboration could not be done normally due to the pandemic, participants worked around this, collaborating using the WhatsApp platform and Google drive tools. Participants taking control over their own learning showed risk-free expression during the study. Participants' feedback also showed risk free expression, as learners expressed criticism at the researcher for certain aspects showing they felt comfortable to do so.

Figure 4.11, shows the analysis of questions one to ten. Nine out of the ten questions showed option 'Yes' received the majority of the percentage value. Question six was the only question where option 'sometimes' received a majority percentage value. Question six would need more probing as this is an essential question and learners think the lecturer was approachable sometimes. This requires additional information from learners as this is a critical aspect of teaching in the classroom, teacher development and collaboration. Also, to note that seven of the ten questions scored above 75% (Figure 4.11) in the yes column, which is a positive

reflection on the study and supports analysed data and findings from cycle two of the questionnaire and observation.

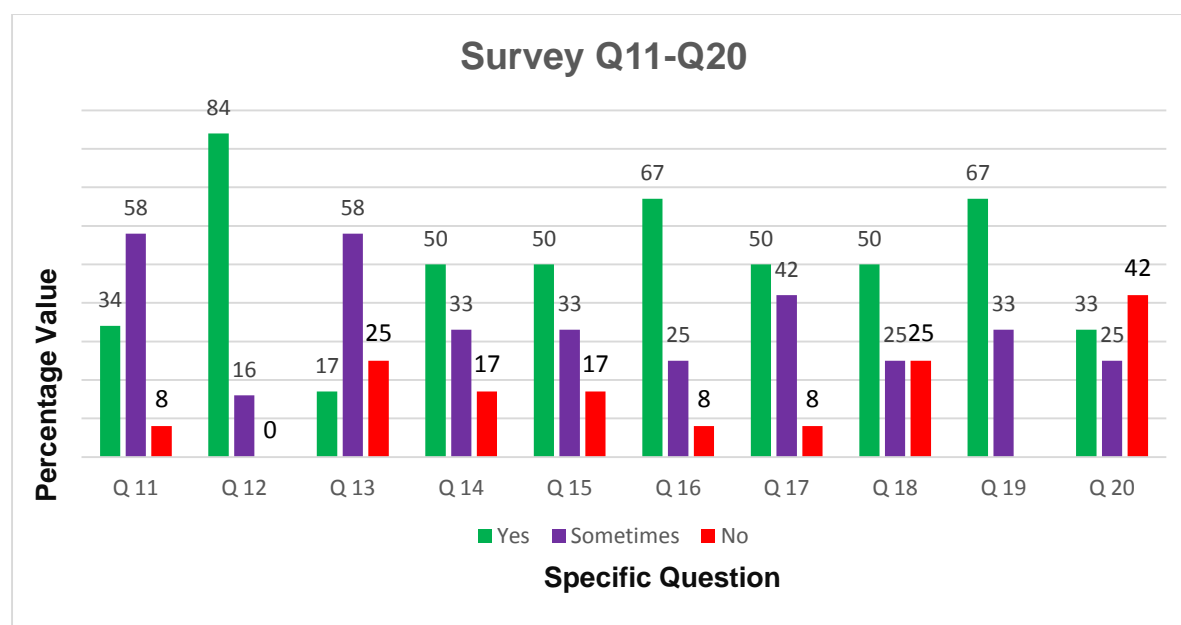


Figure 4.11: Survey Q11-Q20

Figure 4.12, shows the analysis of questions 11 to 20. Seven out of the ten questions (Figure 4.12) scored a majority for the 'Yes' option. Question 11 and 13 scored a majority for option 'sometimes' and question 20 being the only question to score a majority on the 'No' option. However, while question 20 recorded a majority 'No', this was highly positive as the question dealt with the lecturer and his teaching abilities needing to be changed. For questions 11 and 13, feedback was highly negative and are areas of serious concern as a large percentage of learners answered the categories 'Sometimes and No'. These questions will need to be probed further in another cycle to ascertain these responses and gather more detailed feedback. Question 16 shows great potential with this strategy being used in vocational education as 67% of learners answered yes to it being used in a practical workshop setting. There was a contradiction found in the analysis by learner 2 with regards to understanding the module better, who answered question 17 in the survey (see appendix 5) with a yes but answered question 7 in the questionnaire (see Appendix 7) with a 'no' in both cycle one and two.

Analysis of questions 1 to 20 illustrated the positive impact that the flipped classroom strategy had on participants. Eighteen out of the twenty questions indicated positive feedback for teaching and learning. There were two questions of concern which would require more probing

either in another cycle of action research or a secondary study. In the two questions that received negative feedback, both compared the online learning to face to face learning environment. With both questions receiving a majority of feedback for options 'No' and 'Sometimes' which show that participants were still not confident and sure about the new teaching strategy and will require further probing. The analysed data of the closed ended question supports the findings from the previous data collection tools in the study.

4.4.1 Open-ended questions

Questions 21 to 25 were open-ended and data was analysed using thematic analysis. Firstly, each question was analysed individually resulting in codes for each question. Secondly, all codes derived were then grouped together and analysed again using thematic analysis resulting in three themes emerging from the open-ended questions of the survey.

4.4.2 Question 21 codes

After analysing the data using thematic analysis, three codes emerged. The first code was linked to the availability of data. Nine out of the twelve learners (75%) identified this as a problem. Six out of the twelve learners (50%) stated that the college was going back on its promise to provide data and made learning online extremely difficult and annoying. The next code identified was linked to the time constraints; nine learners (75%) complained about the shortening of face-to-face lessons due to covid19 safety protocols adopted by the college. Ten of the learners (83%) explained how the face-to-face lessons were better during cycle one before the lockdown implementation. The third code identified was linked to power and network outages. Nine learners (75%) explained how power outage affected their use of electronic devices. Four learners (33%) argued how load shedding affected their network coverage and ability to learn online. Two learners (17%) specified how they were more affected as they were without power for a week due to a blown transformer in their area.

4.4.3 Question 22 codes

After analysing the data using thematic analysis, three codes emerged. The first code identified was the flexibility of online material reflected by eighty-three percent of the learners. Ten learners (83%) agreed on the flexibility of time and how they could study at any time they chose. Three learners (25%) emphasized the flexibility of place, explaining how they could

study at any location they chose. In the second code, seventy-five percent of learners highlighted the benefits of non-attendance. Six learners (50%) spoke about the ability to continue with their learning even with lockdown in effect. Three learners (25%) explained how their learning was done safely without the stress of covid-19. Five learners (42%) highlighted how they could not worry about transport money and still learn their work. Lastly, in the third code, fifty percent of the learners explain how this strategy improved their understanding of the module. Three learners (25%) explained that this was done due to the online material focusing on the main aspects required for assessment. Seven learners (58%) suggested online with face-to-face lessons improved their understanding. Lastly, four learners (33%) described the constant communication and discussions between lecturer and learners using the online platforms helped with their understanding even when the lockdown was in effect.

4.4.4 Question 23 codes

After analysing the data using thematic analysis, two codes emerged. In the first code, one hundred percent of learners felt that better resources should be given. Six learners (50%) explained the need for data to improve their learning. Eight learners (67%) highlighted the need for laptops to work on as theirs had been stolen, broken, or used smartphones to do their work. Five learners asked for USBs to be allocated to save videos and not depend on data to watch online content. Lastly, six learners (50%) requested textbooks be given as an eBook option to improve their learning. In the second code, fifty percent of the learners argued that other options should be incorporated into the strategy to cater for the loss of time in face-to-face lessons due to the covid-19 pandemic. They suggested that zoom lessons should be made available as an alternate option to cater to this problem.

4.4.5 Question 24 codes

After analysing the data using thematic analysis, two themes emerged. The first code was linked to the cleanliness and tidiness of the classroom. Nine out of the twelve learners (75%) identified this as a problem. Seven out of the twelve learners (58%) stated that this issue made it uncomfortable for them, and cleaning should happen more often due to the covid-19 pandemic the country was facing. Three out of the twelve learners (25%) also complained about the classroom's tidiness and size and felt it was too cluttered with furniture. The next code

identified was linked to the pandemic regulation; five learners (42%) complained about the shortening of face-to-face lessons due to covid-19 regulations, which hindered their learning. Lastly, four learners (33%) argue how personal protective equipment (PPE) hindered their learning. Learners had difficulty hearing what the lecturer was discussing due to his mask, and viewing the whiteboard became challenging as face shields became blurry.

4.4.6 Question 25 codes

After analysing the data using thematic analysis, one code emerged. The code identified was collaboration of lecturer and learners. Eight learners (67%) agreed on the importance of lecturer interaction, suggesting feedback and discussion improved their learning and understanding of the module. Four learners (33%) explained how getting feedback from the lecturer immediately was beneficial to them. Five learners (42%) also explained the importance of peer interaction and how discussions helped their understanding of the modules.

4.5 Overall Analysis of the Codes in the Open-Ended Questions

Upon further analysis and grouping of similar codes that emerged from the five open-ended questions using thematic analysis discussed in the previous section, the following three themes were identified.

4.5.1 Shortage of resources

The first theme was the shortage of resources. This theme emerged in Questions 21 and 23. This is illustrated in the following student responses.

For Question 21, Learner 3 explained: *“data was not given as promised by the college”*. Likewise, Learner 6 said: *“the college never gave data”*. Similarly, Learner 11 argued: *“it’s hard with no data”*. In the same vein, Learner 12 affirms: *“work can’t be done if I was not give data from college”*.

Learner 7 also explained his frustration stating: *“Learning on smartphone frustrated me since the screen is tiny a laptop with be better”*. Likewise, Learner 3 argued: *“need a laptop with*

more space, videos too big for my phone". Similarly, Learner 11 affirmed his difficulty: *"there was too many videos, have to delete one to watch some cause my phone don't have space"*.

For Question 23, Learner 1 shared: *"give us more data bundles or USB for saving video and laptop to make this better"*. Similarly, Learner 7 replied: *"memory card will save data and watch any computer"*. However, Learner 4 explained his needs differently: *"textbook in pdf or eBook is better, even notebook will help learn better"*. Similarly, Learner 9 stated: *"I prefer online text book"*. Likewise, Learner 12 stated: *"give only electronic text book, can save on USB"*.

In Question 21, the majority of learners complained of the lack of data received from the college. This theme is supported by the theoretical framework as it indicates the cognitive presence. Learners were confused with how to continue their learning without these resources, and connecting ideas and exchanging information can be labelled as learners coming up with solutions and thinking out the box on how to overcome this challenge of working together. The social presence can also be used to analyse this theme. Participants not having resources, forced learners to work with each other and share resources. This can describe learner camaraderie, learner collaboration and risk-free learning from the community of inquiry framework.

There were other resources that learners complained about not having and how it impacted their learning. Using mobile devices was one such problem as learners complained such the screen was too small and they had run out of onboard memory. While there were complaints from the lack of resources, learners did give key input on ways to overcome these challenges—the supply of memory cards and sticks to overcome their memory space challenge. In contrast, others wanted their textbook to now be given to them in a pdf format.

4.5.1 Collaboration

The second theme identified from two of the questions is collaboration. This theme emerged in questions 22 and 25. This is illustrated in the responses below.

For Question 22, Learner 1 explained: *"Understanding got better cause I could discuss and work with the others in the group chat"*. Likewise, Learner 5 said: *"Talking to others and*

teacher on the group was better". Similarly, Learner 3 stated: *"Working with friends even in lockdown and teacher still teaching was good. I like classroom to work together is better than WhatsApp group"*.

In Question 25, Learner 4 replied: *"More discussions in class were helping me"*. Similarly, Learner 6 made the same conclusion: *"Discussion in class with lecturer helped and, in the WhatsApp, too"*. In the same vein, Learner 8 replied, *"Working in class with friends helped me more than online stuff"*. Likewise, Learner 10 wrote: *"The group work learning I prefer with friends more easily than with a teacher"*. Lastly, four learners, Learners 1, 2, 8 and 10 gave the exact reply in their feedback stating, *"lecturer feedback"*.

Collaboration could be analysed using the social presence of the theoretical framework. More excellent discussions and feedback between learners and lecturers on social media platforms and face-to-face lessons were evident from the responses that make the strong case and suggests that social presence improved. Collaboration is a crucial part of blended learning and the flipped classroom approach. The data showed that collaboration with the learners and lecturer improved, resulting in better understanding and learning. Learners identified with the concept of working together on the online platforms and using that knowledge in the face-to-face lessons.

4.5.3 Pandemic challenges

The third theme emerged from three questions was Pandemic challenges. This theme was found in questions 21, 23, and 24. Below are some of the illustrated responses.

In Question 21, Learner 1 wrote, *"I don't like short periods too little time to finish work"*. Similarly, Learner 6 said: *"I like the classroom lessons in the first round before corona; now there is too much and little time"*. In the same vein, Learner 11 stated: *"I get late in first lesson cause must fill paperwork for corona, and I miss so much. The queue too long in the morning must get more ladies"*.

For Question 23, Learner 4 stated: *“The lessons are too short now can’t teach in the new time. They must use Zoom to help”*. Likewise, Learner 6 wrote: *“Zoom will help better because time in class is less cause of corona”*. Correspondingly, Learner 12 explained: *“Skype and zoom will be nice now cause corona timetable very shorten and can’t see teacher enough for discussion”*.

In Question 24, Learner 1 wrote: *“Cleaning not done enough, and it worries me in the class cause of the corona.”* Likewise, Learner 2 replied: *“It hard to learn cause I am scared of the corona, and these ppl do not clean class properly.”* Correspondingly, Learner 10 said: *“Using mask and shield is hard to ask questions”*. In the same vein, Learner 12 replied: *“Teacher talking in mask sometime hard to understand not clear and our face shield make the board blurry to see”*. Lastly, Learners 4, 6 and 7 wrote the exact feedback for this question stating: *“Lessons too short with corona”*.

The pandemic theme can be analysed using the cognitive presence of the community of inquiry framework. Learners had a sense of puzzlement about connecting ideas. Being able to learn under new safety regulations was difficult. Being unable to understand the lecturer with a safety mask and coping with shorter face-to-face time, yet still connecting the ideas and overcoming this challenge only supports the framework's cognitive presence. The following section presents and analyses data generated from the focus group discussion.

4.5.4 Focus group discussion

The last data collection tool used was the focus group discussion. The purpose of the focus group discussion was to acquire a comprehensive understanding of students’ experiences and feelings towards using blended learning using the flipped classroom approach in a TVET learning space. The focus group discussion was conducted with twelve participants. An inductive approach using thematic analysis was used to analyse data generated during the focus group discussion. All data transcribed from the focus group discussion was coded for similar keywords, concepts, and phrases—these codes were then grouped into themes. While the themes are individually unique, some codes are prevalent in more than one theme due to them being so closely related and it being difficult to isolate them. Codes used for developing the pandemic theme were also found to explain ideas and questions in lack of resources and

collaboration themes. Likewise, it was found that the flexible learning theme can be used as a vital category to define theme five learner autonomy.

Table 4.1 outlines the codes, five themes and the indicator for the framework. Also found in each table is the indicator of a presence found in the community of inquiry framework. The three presences represented are social, cognitive, and teaching presence. At the end of the table, screenshots of WhatsApp conversations were added to show raw data that could be used to support the pandemic and collaboration theme. This data also strengthens the framework's use by giving support to the teaching and social presence found in the community of inquiry framework. The following question guided analysis:

To what extent does blended learning and a flipped-classroom approach enhance students learning in basic electronic tools and measuring equipment in Electronic Control and Digital Electronics level 2 at a TVET College?

Table 4.1 Codes and themes for focus group discussion

Code	Theme	Link to framework
L4: Time isn't limited I work at my pace L6: The positive I control when to do the work and what time and even what section to do. L4: Online for me is more uh uh effective and I like learning my pace. L3: The time flexible was nice, I work at my pace at home neh. L9: Positives is the time is flexible, do learning at home, I work at my own time L8: Positive I can work at home, my time L5: Positive, was flexible, I can pick up what I want in my time at home to learn. L9: I can catch up on missed work, let me focus on the main mark sections. L1: Was positive we had more time when we did work at home in our own time and was flexible. Can always rewind and pause the videos.	Flexible Learning	Cognitive Presence
L5: Ya data wasn't enough some time		

<p>L6: I needed bigger screen, I use phone and not clear sometimes. more data they must give us</p> <p>L8: I didn't have lort data, plus my computer was stolen. I had to share a lap top</p> <p>L9: Negatives, uhh I have network problems at home, internet don't work all time, I finished my data doing this work</p> <p>L 12: Phone college for data and they didn't give me. I ran out of space on mobile.</p> <p>L13: I had problems running out of data.</p> <p>L4: Data too expensive and college did not want to give data to us.</p> <p>L2: Negative: data was finished and college did not give us data. Videos were big size and space got finished on mobile</p>	<p>Connectivity and computer challenges</p>	<p>Social Presence & Cognitive Presence</p>
<p>L7: It save me time and keep me safe during Covid time the online stuff</p> <p>L4: Online is important because of this Covid thing happening.</p> <p>L8: To use WhatsApp to keep contact because of corona.</p> <p>L9: Was safe at home since was lockdown.</p> <p>L11: I prefer online cause it keep me safe since there is Covid.</p> <p>L10: I caught up on work I missed in class during strikes and kept me safe during corona.</p> <p>L12: During lock down I was still learning online</p> <p>L2: Negatives, corona made timetable less, lost class time for practical's</p> <p>L5: We were protected from Covid, catching up was easy with the WhatsApp group</p>	<p>Safety during Covid-19 Pandemic</p>	<p>Teaching Presence & Cognitive Presence</p>
<p>L4: I can tell teacher what I don't know on WhatsApp, he help me online or in class, which helped me</p> <p>L5: Was hard adjusting doing everything alone, I like to do group work with friends that help me sometimes.</p> <p>L3: Positive I can work at home, my time and then tell teacher what I don't understand in class.</p> <p>L2: I got enough time to do all work I miss out in class, can talk to lecturer on WhatsApp to ask questions and I was saved from Covid.</p> <p>L8: So I can work on my own at home and come to the lecturer with challenges I have. I improve my learning.</p>	<p>Collaborative Learning</p>	<p>Social presence & Teaching presence</p>

<p>L9: I struggled to download videos, had to copy it from friend.</p> <p>L11: I battled cause I missed some face lessons and was lost. Learner 4 helped me to catch up</p> <p>L12: If u missed lesson or late to class can watch the video and catch up. Like the WhatsApp to keep in touch with everyone.</p> <p>L1: Gave me time to catch up with work I missed because of strike and late coming. WhatsApp let me be in touch with everyone even you.</p>		
<p>L4: It allowed me to realise I have a concentration problem and can't learn for too long</p> <p>L3: It had both positive and negative for me. It tested my abilities to finish work without lecturer forcing and help. It boosted the level of my focus cause it was hard with noise at home.</p> <p>L5: For me the benefit was learning on my own, it made me self- independent in learning</p> <p>L6: I got to learn a new way first time like this. Teaching like this is different but nice. This style suit me in learning.</p> <p>L2: I got to learn somethings even better, feel it makes me understand better</p> <p>L7: To know how to work on my own</p> <p>L8: Yes it improve my learning because the videos make more sense sometimes.</p> <p>L9: It improve the understanding and give me more options.</p> <p>L10: I was able to understand work more cause I was in a quiet space and alone so I could focus the videos.</p> <p>L12: Both, cause I get more work done, I have to plan to do and complete the work. Understand more in this subject now with videos and style.</p>	<p>Improved understanding and self-development</p>	<p>Cognitive presence</p>

4.5.5 Presentation and analysis of data emerging from the Focus group discussion.

In the literature review outlined in Chapter Two, several descriptions and explanations of blended learning and the flipped classroom were discussed.

Learner 5 in this study explained her preference stating, *“Online is much better if u start at class and go online for videos to make things much easier and fast”*. Similarly, Ruhalahti et al. (2017) argue that blended learning as a concept is currently being used in environments that use online and face-to-face instruction (Graham, 2006; Wagner, 2006; Kennedy & Archambault 2012). Learners 4 and 6 agree blended learning encourages active learning, with Learner four explaining how *“it gives me 2 types of info, the notes plus videos* and Learner 6 supporting the statement arguing, *I got to learn a new way first time like this. Teaching like this is different but nice. This style suit me in learning”*. Likewise, Tucker (2012) and Strayer (2012) assert that the flipped classroom method can be regarded as a particular category of blended learning which they acknowledge as the most general and dynamic approach that can be used.

Bishop and Verleger (2013) and Milman (2012) argue that the flipped classroom must be a learner-centered technique that contains two parts, a specific teaching model based directly on a computer after lessons, and collaborative learning activities during lessons which make use of various teaching and learning styles such as group work, discussions, videos and podcasts. Similarly, this is the effect that Garrison and Vaughan (2008) explained in their community of inquiry framework for adopting a blended approach. It requires a change in teaching strategies as the focus is on learner-centred learning where the lecturer becomes a facilitator. This is in line with Learner 4, 5 and 6 and their personal feedback about what blended learning has brought personally to their learning environment.

4.5.5.1 Theme 1 Flexible learning

Learner 6 expressed himself stating, *“The positive I control when to do the work and what time and even what section to do”*. Likewise, Blended learning studies have shown that it can be used to facilitate flexibility and access (Graham et al., 2005; Osguthorpe & Graham, 2003). Online technologies have been one of the key facilitators of change in blended learning. This is due to the more flexible, innovative, and flexible training that can result from blended learning. The majority of the participants agreed that flexibility of learning was a key advantage of using this strategy. Learner 4 commented that, *“time isn’t limited I work at my pace and online for me is more uh effective and I like learning my pace”*. Learner 7 explained a key point about the importance of flexibility to him personally and stated: *“I couldn’t make it to come for class lessons due to transport money so online really help me to get the work done and can catch up on missed work, also let me focus on the main mark sections”*. According to Chen et

al. (2017), learning from online platforms happens according to individuals' own pace and needs as learners now have options to replay, pause and rewind videos. Learner 1 identified most with the above argument stating: *"it was positive we had more time when we did work at home in our own time and was flexible. Can always rewind and pause the videos"*. Similarly, Learner 4 agreed explaining: *"time isn't limited I work at my pace, things I don't understand, I rewind and pause on video, I see the video anytime cause I got it on the phone"*. Other participants shared similar experiences and views. Learner 6 explained: *"the positive I control when to do the work and what time and even what section to do"*. Similarly, learner 9 explained how: *"the flexibility to work when and for how long benefited his learning"*. Likewise, Learner 3 said: *"the time flexible was nice, I work at my pace at home"*. Similarly, Learner 8 shared: *"positive I can work at home, my time"*. In the same vein Learner 5 also stated: *"it was positive, was flexible, I can pick up what I want in my time at home to learn"*.

Flexible learning emerged from the focus group data as one of five themes. In the first theme, flexible learning, data was analysed using two of the three cognitive descriptions from the Community of Inquiry framework, namely, connecting ideas and having a sense of confusion. Learners trying to understand this new online learning strategy and the extra time and space expressed a sense of puzzlement and connected ideas. Learners were given a range of options to modify their learning practice based on their individual needs and inclinations. Collis and Moonen (2001) explain that improving flexibility means essentially conquering difficulties emerging from the rigidity of traditional forms of education by enabling learners to choose what is ideal for them concerning crucial dimensions of learning. This allows for a learner-centred approach which can lead to improvement in cognitive levels. It was evident that learners engaged in connecting ideas using their understanding of online platforms and merging it with their syllabus to apply it to the strategy and to continue with their learning at a time and location that was convenient for them.

It was evident from the focus group discussion that this new strategy was not a one size fits all model; and those learners appreciated that they had the flexibility to work with their strengths and weaknesses at their pace, location, and time. Participants being allowed to decide how and when they learn afforded them greater responsibility for their learning. Participants' responses from the focus group support this argument. Learner 5 explained how being able to control her learning taught her responsibility stating: *"for me the benefit was learning on my own, it made*

me self-independent in learning and whoo the time flexible was nice, I work at my pace at home neh”.

Flexible learning was identified as an important theme as it came across multiple questions of the focus group. Blended learning using the flipped approach provided more control for online use while creating more accessibility and flexibility for classroom learners by integrating online and face-to-face learning. Arnold-Garza (2014) affirms that blended learning caters for different learners' needs, those who need more time to analyse, manage or pause and for learners who grasp knowledge faster and are ready to move onto the next concept. As a result of learners taking responsibility in this approach, O'Flaherty and Phillips (2015) argue that there is the potential to prepare learners in learning and working environments to address labour shortages, a task mandated to TVET colleges in South Africa.

4.5.5.2 Theme 2 Connectivity and computer challenges

Learners in this study voiced their concerns on this matter numerous times throughout the focus group discussion. According to Roehl et al. (2013), it is crucial to recognise financial limitations when using a flipped-classroom approach. These limitations can affect teachers, learners, and public schools having limited financial resources. Learners were not supposed to do all online activities on their own at home. Initially, it was planned for them to use TVET college resources such as the computer laboratory to help with online activities for this study, but TVET college resources were not available due to the pandemic.

As a result, participants had some challenges that were common while others were unique to the individual. While learner 5 had similar complaints about data, she highlighted the problem of continuous load shedding South Africa was facing and how this disrupted her learning. She explained: *“Ya data wasn't enough sometimes, load shedding night time was a problem for me, cause I learn at night cause busy at home during day. Couldn't learn no power. I don't like using the candle”*. Learner 9 also faced network problems as a result of load shedding stating: *“Negatives, I have network problems at home, internet don't work all time when load shedding, I finished my data doing this work”*.

Participants who did not have access to laptops showed remarkable ingenuity in coming up with plans to overcome this challenge. While most participants chose to use their cellphones,

this also presented problems. Learner 6 explained: *“I needed bigger screen, I use phone and not clear sometimes and more data they must give us”*. Likewise, Learner 1 faced a similar issue with the phone, explaining: *“data was finished and college did not give us data. Videos were big size and space got finished on mobile”*.

Learners also faced problems with regard to laptop access. While all participants did not have laptops, some could borrow and share laptops with other participants. Learner 8 did not have a laptop due to the theft of his resources and made a plan to share: *“I didn't have lot data, plus my computer was stolen. I had to share a laptop and this made learning difficult”*. Learner 10 had no choice but to share a laptop as his phone had stopped working and due to the lockdown was not able to have it repaired: *“Negatives, I had to share a laptop and my phone wasn't working”*.

The primary challenge most learners explained in their responses was the problem of not having enough data to complete work or go through the given resources. Learner 12 explained: *“Negatives, corona made timetable less, lost class time for practicals, video don't help with that. Phone college for data and they didn't give me. I ran out of space on mobile”*. In the same vein, Learner 3 stated: *“I had problems running out of data”*. Learner 4 shared similar challenges: *“Opening of google drive was a problem first but ok now, data too expensive and college did not want to give data to us”*. Learner 1 also mentioned: *“Negative: data was finished and college did not give us data. Videos were big size and space got finished on mobile”*.

However, while most participants shared these challenges, Learner 11 argued that: *“data was never an issue as she used the money, they received for their transport to buy data as they did not need it for transport to college”*. Similarly, learner 10 agreed explaining: *“Data did not trouble me cause the transport money they give us, I use it to buy my data”*. This resulted in an argument between participants, as some students believed that it was the responsibility of the TVET college to provide students with data and that the transport money was their own. This was a challenge as the TVET College did not have the funds to pay for data since this was not budgeted for.

In theme 2, connectivity and computer challenges, the social presence was used to analyse data. As learners did not have resources or had technical challenges with equipment, they often

sought help from other classmates and the lecturer, borrowing resources and working together. This can be paired with the descriptions of encouraging collaboration and camaraderie among learners, which can be explained by the social presence of Garrison and Vaughan's community of inquiry framework. Learners were uncertain about how to continue with their learning without these resources; however, connecting ideas and exchanging information can be described as learners coming up with solutions and thinking out of the box to work together and overcome this challenge. Collaboration and working together also resonates with the social presence. While facing this key issue of lack of resources, learners still accessed the information required and still participated in lessons and continued their learning experience using their own resources.

Mafolo (2020) explained how DHET had funding cuts to cater for the Covid-19 pandemic facing South Africa. van Schalkwyk (2021) argues that the DHET identified the data cost as a potential barrier and reached agreements with network providers to make their sites zero-rated to support online learning and prevent learners from incurring extra data costs. However, this applied to universities only and not the TVET sector as they do not cater for online learning in most of their curriculum. Senior management at TVET colleges were handed the reins to make their own decisions on how to handle teaching and learning during the pandemic effectively. Jordaan (2020) reported that 46% of learners had difficulties with online participation and completion of assessments due to the lack of data and computer equipment. Similarly, Molosankwe (2020) explained that learners pushed back against institutions and argued that it was unacceptable to expect them to participate in online activities without the necessary resources.

4.5.5.3 Theme 3 Safety during Covid-19 Pandemic.

As the Covid-19 pandemic was a new crisis that emerged, there was not much literature about its effects on blended learning and the flipped classroom. However, data from the focus group discussion highlighted some positives and negatives of doing blended learning using the flipped approach during the pandemic. With South Africa going into level 5 lockdown and lessons being suspended indefinitely, all teaching and learning came to a stop at the TVET

College. However, the introduction of blended learning for this study benefited the learners during the pandemic. This is evident as Learner 11 explained while all other learning stopped in their other subjects during the lockdown, learning continued with Electronic Control & Digital Electronics (ECDE) because of blended learning and its social media and online platforms. *“During the lockdown, I was still learning online, other subjects we had nothing to do”*. Learners 6, 7, 9, and 10 spoke and emphasized the online platform's benefits and how important it became during the pandemic. Learner 6 emphasized the use of online and its benefits explaining: *“We were protected from Covid, catching up was easy with the WhatsApp group”*. Similarly, Learner 7 stated: *“It keep me safe during Covid time the online stuff important and because of this Covid thing happening”*. In the same vein Learner 9 argued: *“I prefer online cause it keep me safe since there is Covid”*. Correspondingly, Learner 10 said: *“I benefited from this style cause and kept me safe during corona”*.

The third theme focused on safety during the Covid-19 pandemic. Due to the Covid-19 pandemic, learners experienced a new teaching method and experienced changes in their learning activities. New regulations on social distancing affected the way face-to-face lessons were carried out. This can be explained using the teaching presence as TVET lecturers applied new ideas, revised the curriculum and focused discussions. The lecturer had to plan how to deliver the curriculum in the shortened time frame and identify delivery modes that were best suited to the changing teaching context as a result of the Covid-19 pandemic. While doing this, he had to keep learners focused on the main content and their vocational assessments.

While learners experienced these new approaches and methods of teaching due to the pandemic regulations, they also had to make sense of using these new methods and learning, and how to get the best out of these new learning styles. Learners had to use online platforms with greater frequency to ask questions, obtain feedback, and improve their understanding. This could be associated with the cognitive presence descriptions. Having a sense of confusion, exchanging information, and connecting ideas can be related to learners dealing with and understanding the lecturer's new approach to teaching during the Covid-19 pandemic and their new approach to learning.

While learners were afraid of the pandemic and anxious about the daily news with an increased number of deaths, it was comforting for learners that they could learn in the safety of their homes. Therefore, a blended learning approach seemed to offer learners a little more protection from the virus and gave learners a sense of safety from the Covid-19 pandemic. On the other hand, Learner 2 highlighted how the Covid-19 pandemic affected his learning negatively.

Learner 2 had a problem with face-to-face time being shortened when he returned to class and stated *corona made timetable less, lost class time for practicals*.

4.5.5.4 Theme 4 Collaborative learning.

According to Jones and Lau (2009), universities move from an entirely online delivery to a blended learning model because of the importance of social interaction. Learner 5 reiterated this, explaining: *“Was hard adjusting doing everything alone, I like to do group work with friends and working with everyone, that help me sometimes”*. Likewise, Learner 12 agreed with the statement: *“Like the WhatsApp to keep in touch with everyone”*.

According to Ogden et al. (2014), collaboration is a key component that allows for an effective flipped environment, even if the lesson may seem unsystematic, loud, or even chaotic; however, this collaboration benefits the learners understanding and learning processes. Learner 4 explained how his learning and understanding benefitted from collaborating with the lecturer using the online profile: *“I can tell the teacher what I don't know on WhatsApp, he helps me online or in class, which helped make me understand more better”*. Similarly, Learner 8 shared: *“Can talk to lecturer on WhatsApp to ask questions and I was saved from Covid”*. While this showed collaboration, specifically with the lecturer, the participants explained how they were forced to collaborate with their classmates due to the Covid-19 pandemic and how it benefited them. Learner 9 explained this stating: *“I struggled to download videos, had to copy it from friend”*. Likewise, Learner 10 said: *“I struggled to download videos; friend did it and used her pc”*. Correspondingly Learner 11 argued: *“I battled cause I missed some class lessons and was lost. Learner 4 helped me to catch up”*. In the same vein Learner 2 contends: *“Can contact everyone in the group chats for help”*. This analysis of data contradicts the analysis and findings of the survey. Question 6 of the survey (see appendix 5) contradicts analysis of the focus group discussion see Appendix 6. Participants stated that the lecturer was approachable sometimes but clearly stated in the focus group discussion that collaboration between participants and lecturer improved supporting the social presence of the study.

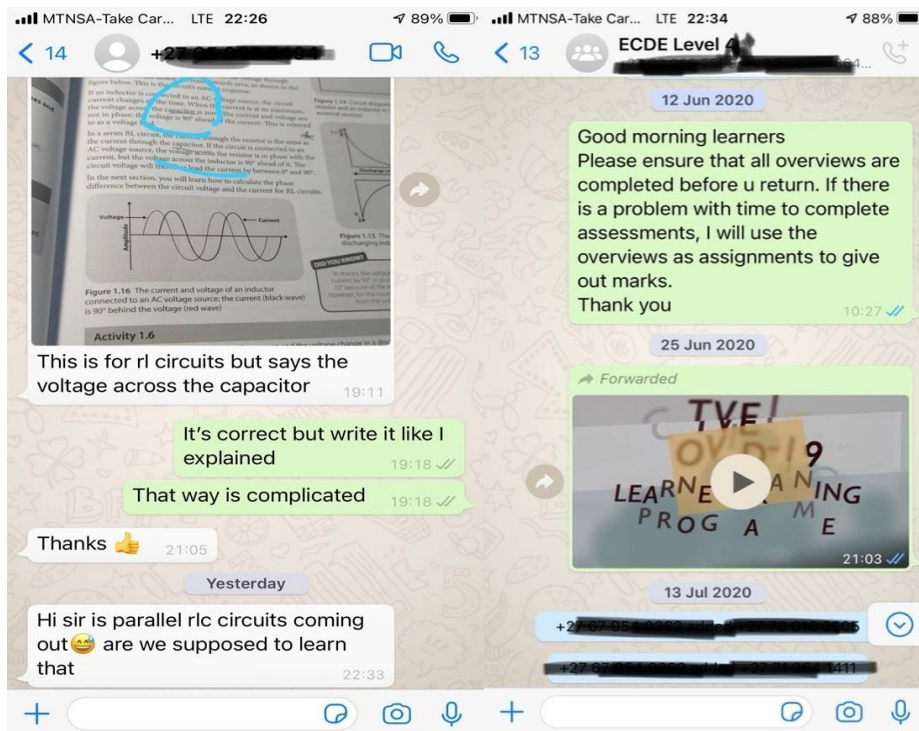


Figure 4.12 WhatsApp data presentation

The WhatsApp group and individual chat was part of the flipped classroom strategy, and is included to highlight how it supported the themes identified. Creating the WhatsApp group was initially planned as a medium for the researcher to give and receive instructions and feedback on work to be done. However, with the onset of the Covid-19 pandemic and South Africa going into level 5 lockdown, it became an essential communication and learning tool with all learners to keep in touch with each other and the lecturer. This was extremely important as some learners chose to go back home to other provinces and towns before the lockdown, making the WhatsApp group chat the only place where everyone in the class could communicate and keep in touch for academic and personal reasons. This is summed up by Learner 9 who stated: *"I prefer online cause it keep me safe since there is Covid. It improve the understanding and give me more options. The time is flexible, do learning at home, I work at my own time"*.

Collaborative learning was identified as the fourth theme in the focus group discussion and could be explained by the social presence aspect of the community of inquiry framework. Throughout the study, collaboration was taking place between learners and lecturer and learners. Learners used the social media platform, WhatsApp to collaborate with each other and the lecturer. Learners kept in touch with each other and passed information to one another

either in the WhatsApp group chat or personally with the lecturer. The WhatsApp group chat created a more relaxed environment where learners felt more at ease to express themselves without any consequences. This resulted in face-to-face lessons being open, where learners felt more at ease with the lecturer. Enabling risk-free expression, encouraging collaboration, expressing emotions, and camaraderie were associated with this theme and learner actions through the raw data.

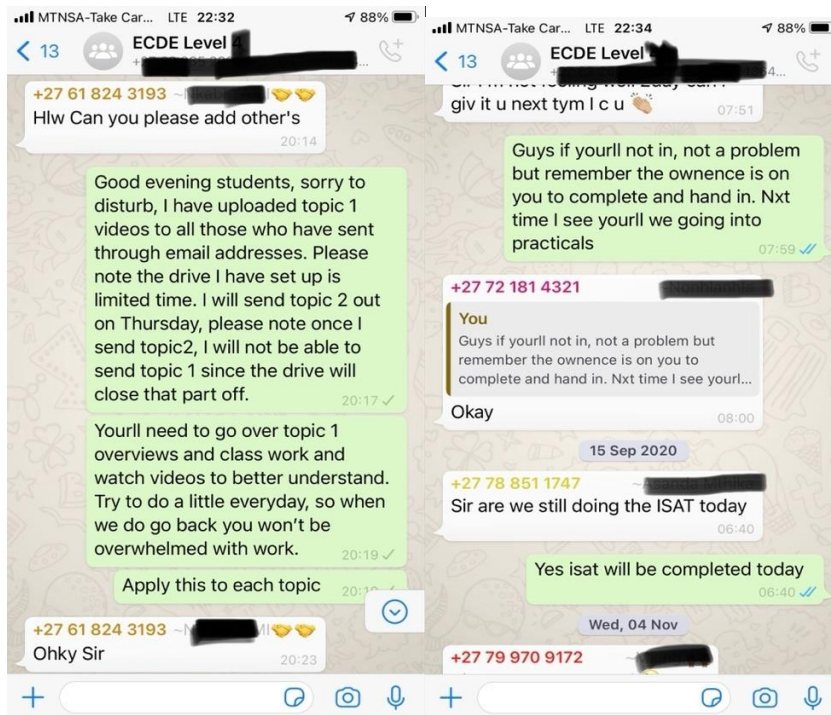


Figure 4.13 WhatsApp data presentation

The teaching presence was also evident as the lecturer used the WhatsApp group chat to keep the learners focused by controlling the discussion when learners went off-topic. The WhatsApp group chat was also used to apply new ideas and methods to help when learners faced difficulties with the study material. During lockdown level five and no face-to-face classes, the WhatsApp group chat was primarily used as a new teaching platform.

Anderson et al. (2001) contends that there is a focus on collaborative processes during the face-to-face lesson, which tends to use applications such as analysing, developing and creating solutions, and contextualising information. However, during this research study, collaborative processes were also clearly evident during the online processes.

4.5.5.5 Theme 5 Improved understanding and self-development.

Learner autonomy refers to learners taking responsibility for how they learn and what they learn, thus controlling their self-development. Learners liked having the flexibility and control to choose when and how to study. It was evident that this made learners proactive and more self-aware of their learning situations and environment. Learner 4 explained that he could not concentrate for long periods: *“It allowed me to realise I have a concentration problem and can’t learn for too long”*. As a result, he had to change the way he learned. Learner 5, on the other hand, explained how she was able to complete work on time without being pressured by the lecturer and external challenges at home: *“It had both positive and negative for me. It tested my abilities to finish work without lecturer forcing and help. It boosted the level of my focus cause it was hard with noise at home”*.

To develop their learning autonomy, learners must have different learning strategies that could be used flexibly to suit the context. It was evident that flexible learning also played a role in improving learners' understanding and self-development in this study. Learner 9 described the importance of having the flexibility that helped him specifically improve in other areas: *“I prefer online cause it keeps me safe since there is Covid. it improve the understanding and give me more options. the time is flexible, do learning at home, I work at my own time”*. Another clear contradiction was found between the focus group discussion (see appendix 6) and the open-ended questions of the survey (see appendix 5). Question 21 of the survey tool and Question 3 of the focus group tool looked at challenge's learners had with this new strategy. Learners 3, 5, 7 and 11 contradicted themselves either by answering one data tool stating they faced no challenges while in the other describing the challenges they faced. Learner 9 had the clearest contradiction, stating in Question 22 of the survey he did not like any part of this strategy and it did not help him. However, during the focus group discussion the learner gave reasons as to why this strategy benefited him and improved his learning and understanding of the module.

Ramírez et al. (2014) and Mason et al. (2013) contend that learner autonomy leads to enhanced cognitive thinking, better learning adaptability, and improved independence and learner accountability. Learner 5 agrees explaining: *“For me the benefit was learning on my own, it made me self-independent in learning”*. Likewise, Learner 7 states: *“To know how to work on my own”*. Similarly, Learner 10 explain: *“I was able to understand work more cause I was in*

a quiet space and alone so I could focus the videos". Correspondingly Learner 12 contends: *"Cause I get more work done, I have to plan to do and complete the work. Understand more in this subject now with videos and style"*. In the same vein Learner 14 adds: *"It improves my learning by making me understand the topic clear when was looking at the video after the book stuff"*.

Improved understanding and self-development was the fifth theme identified. Learner autonomy can be analysed using the cognitive presence dimension of the community of inquiry framework. Learners applied new ideas, connected new ideas, and exchanged information. Throughout the study, learners had to adapt to constantly changing situations as a result of the Covid-19 pandemic. They had to take responsibility for their learning. As a result, learners learned more about themselves and what they could and could not do. Many of the learners explained how they learned to focus, work independently, be self-independent with their learning and learn without being told to do so. All these are traits of cognitive improvement and learner development. It was evident in this study that learners were engaging in critical thinking, being creative, and developing and improving their communication skills. This was a marker for learner autonomy and cognitive presence.

Learners' responses in this study suggest that learners' self-independence improved gradually. They were uneasy during the first cycle, but after they understood the processes and what was required of them, most of the learners took the initiative to ensure that the work was completed and that they understood the lessons. As a result, communication during face-to-face lessons and on the WhatsApp group chat between the lecturer and learners improved tremendously. This was evident before starting the second cycle when learners gave their opinions and suggestions on what needed to be done differently in the second cycle to improve the strategy. According to data from the second cycle, this seems to have helped their learning and understanding as there were vast improvements.

4.6 Conclusion

The focus of this chapter was the presentation and analysis of data using the Community of Inquiry theoretical framework of Garrison and Vaughan. This chapter presented the results from both the quantitative and the qualitative data collection instruments. Quantitative data extracted from the questionnaire, observation schedule, and closed questions were represented graphically in the form of pie charts and column graphs. The survey and focus group's

qualitative questions were analysed using thematic analysis, which discussed the codes and themes created. The themes were then aligned with the theoretical framework and relevant literature. The discussion of the findings, conclusions and recommendations are presented in the next chapter.

Chapter 5 - DISCUSSION AND CONCLUSION

5.1 Introduction

This study aimed to explore how blended learning using the flipped classroom approach enhanced student learning in Electronic Control and Digital Electronics at a TVET College. The purpose of this action research study was also to improve my teaching practice of basic electronic tools and measuring equipment. This chapter discusses the data analysed in the previous chapter to address the research question:

To what extent does blended learning and a flipped-classroom approach enhance students learning in basic electronic tools and measuring equipment in Electronic Control and Digital Electronics level 2 at a TVET College?

This research employed Garrison and Vaughan's (2008) community of inquiry framework to analyse data. Following the discussion of results, the key findings of this study are summarised and recommendations for further research are outlined. Next, the limitations of this study and conclusion are discussed.

5.2 Discussion of results

This section discusses the findings of the study that emerged from the data analysis and emerging themes, in response to the research question mentioned above. Garrison and Vaughan's (2008) community of inquiry framework was instrumental in analysing how best to apply blended learning using the flipped classroom approach. It became necessary to emphasise what adopting a blended approach meant as it was apparent from the literature that there are different perceptions of blended learning and the flipped classroom approach. Garrison and Vaughan (2008) highlight the prerequisite of using technology to bring about constructivist learning, which is significant and profound for learners. This research study's data distinctly promotes blended learning as a change in pedagogy that embraces learners' unique learning styles.

While all participants had the same module and scope of work to study, learning was still individualised. Learning took place under different circumstances for each learner due to their motivation to work with technology using this strategy. While most learners embraced using technology in their learning and saw the benefits it could have for their personal growth, they

also acknowledged the challenges it brought to them. Their own experiences with social media platforms and the pressures of passing the module inspired their learning. Through their responses, they believed that using technology does have the potential to advance their learning. Blended learning using the flipped classroom approach encouraged a more learner-centred approach. The linking of skills, attitude, personal understanding, and cognitive dissonance helped to create preferable circumstances to support learner-centred teaching while dynamically using technology. Likewise, Arikan (2008, as cited in Kosar, 2016) affirms how online environments can enable learner-centeredness to act as a medium for increasing learning in other fields.

While numerous researchers agree that technology and online platforms are a valuable tool in the classroom (Ruhalahti et al., 2017; Ramakrisnan et al., 2012; Boelens et al., 2017; Callan et al., 2015; Kaur, 2013), this moves away from the definition of blended learning. The most common purpose of blended learning is to combine the best of both traditional and online learning (Young, 2002; Graham et al., 2005). Correspondingly, López-Pérez et al. (2011, p.819) explain the importance of different teaching and learning methods which

a) enables students to acquire a deeper understanding of the subject; b) promotes positive perceptions of the teaching received; c) clarifies goals and rules; and d) provides students with a higher level of independence in the learning process.

This importance of blended learning concurs with Kosar's (2016) idea that blended learning supports learner-centred teaching and learning, and requires further exploration in future studies to inform teaching and learning practices at TVET colleges in South Africa.

In their framework, Garrison and Vaughan (2008) explain the cognitive presence requirement when using online platforms in tertiary institutions. The learners' responses helped confirm the indicators of the cognitive presence in this study as outlined by the community of inquiry framework. These elements enriched learning to use technology and online platforms. As discussed in the previous chapter, the pandemic facing the country resulted in greater collaboration, as Garrison and Vaughan (2008) identified when using the blended approach. All participants in this study experienced some of the cognitive presence indicators when taking part in this study. While they were not too eager and enthusiastic during cycle one, this changed in cycle two. They showed greater willingness to apply new methods and ideas while making greater use of the WhatsApp platform to exchange information. Watching learners show a vast improvement was advantageous and motivating, especially those who overcame cycle one's challenges. These encouraging factors affirm the findings made by Okaz (2015) that the integration of technology and face-to-face learning can have meaningful outcomes since it can

reinforce communicative and interactive learning. However, the cognitive presence also had challenges when learning to introduce technology and online platforms. Some of these difficulties resulted technological issues which do not support new ideas sufficiently. Not all software and online platforms that are chosen are user-friendly and can be used by the different institutions, and the use of new online tools can be more daunting than helpful. Collaborating with fellow participants can be challenging if learners are not used to the platform and do not have the resources needed to function on the platform. Herreid and Schiller (2013) agree these difficulties are experienced when integrating technology into classroom teaching. As a result, Aydin and Demirer (2016) argue that learners can be left behind in the class modules resulting in different learning rates, which are problematic for teachers to cope with.

Similarly, this only further strengthened the argument of the role technological support had when influencing online platforms. As teaching and learning edge closer into a more technologically advanced platform, there is a need to focus on the cognitive presence. Encouraging learners how and when to construct their understanding and meaning through information processing during learning will entail more research and strategies for teacher development at TVET colleges. Garrison and Vaughan (2008, p.23) affirm this notion stating, "Establishing and maintaining cognitive presence in blended communities is the area that is in greatest need of research."

The community aspect of using online collaboration refers to the social presence in a blended approach. This study focused on the collaboration between learners and learners with the lecturer while using online and face-to-face platforms. Numerous participants acknowledge using the WhatsApp platform as a tool to collaborate with other learners and the lecturer, resulting in an improvement in their learning and understanding. What was encouraging, learners who did not ask or engage in specific questions on the social platform still learned from the responses of other participants and the lecturer on the social media platform. The importance of social presence in the community of inquiry framework was a motivating factor in creating the WhatsApp platform in this study. While learners still enjoyed the face-to-face sessions, the flexibility afforded to them by online platforms was greatly appreciated. The indicators for social presence enhanced learning in this study. Feedback from learners supported the social presence elements, which were encouraging collaboration, expressing emotion, and camaraderie, which came through in all data collection tools.

However, while these findings do correspond with other studies, some elements also disadvantaged learning. Learners who did not engage in online collaboration or face-to-face have been identified as a critical challenge that would impede this strategy's use. It was noted

during the observation of cycle one and the focus group session, some learners did not respond to the questions and allowed their peers to give all the feedback. As a result, blended learning using the flipped approach advances active and collaborative environments that cater for a deeper understanding of concepts during flexible learning times and collaboration (Franci, 2014; Chen et al., 2017; Amiryousefi, 2017). Enabling risk-free expression and feedback was encouraged throughout the study; allowing feedback from learners for the questionnaire and survey to be anonymous without repercussions also supported this social presence.

In the community of inquiry framework, the teaching presence plays a crucial role in whether a blended learning strategy could be deemed a success. Using an intervention of blended learning and a flipped classroom approach, the teaching presence was significantly emphasised in this study. However, the emergence of the Covid-19 pandemic resulted in me having to make adjustments to my teaching strategies. Initially, the WhatsApp chat group was created for communication and encouraged discussions among participants; however, the platform was used more regularly as a teaching tool during the study. With the shortening of face-to-face lessons, I had to summarise more theoretical aspects of the curriculum to save time that could be spent more actively in the classroom. The summary of content was required on a more regular basis as safety regulations affected the assessments too. However, learners appreciated and preferred these new teaching strategies that were planned and suggested than the changes being implemented permanently. The feedback from learners clearly explained that new ideas were required for practical assessments as the shortened time impacted this new strategy severely, and this could not be summarised.

Even though most learners coped with using the online platforms, there were a few learners who had difficulties working these platforms. One learner struggled with the functionality of Google drive and collaborated with other learners to gain an understanding. During the study, there were times when instructions about implementing tools had disrupted the learning process due to not being clear and concise, but this was quickly rectified using the group chat. The WhatsApp chat group was created to support the blended approach while strengthening learning, understanding, and collaboration, which was accomplished in this study.

From the study's findings on whether blended learning using the flipped approach enhanced learner's understanding, it could be argued that the teaching, social and cognitive presence is vital to getting a positive outcome. Garrison and Vaughan (2008, p.24) argue the teaching presence "provides the design, facilitation, and direction for a worthwhile educational experience" and can be linked to the methods used in the teaching presence when using the blended approach. However, there are negative aspects to consider that could be detrimental to

the blended approach. Challenges that arise from the teaching presence as the online environment being used can be defined and influenced by the institution's policy directives. However, this study did not face this issue as blended learning at this TVET College is relatively a new concept, and there are no policy directives in place. Another challenge is that some may find this idea of teaching complex and daunting, resulting in facilitators losing interest while it is assumed learners' competencies with technology is the only factor that is important and vital when adopting a blended approach. However, this is not the case; learners need to be skilled at other categories to be successful at blended learning. As a result, Grabau (2015) argues that learners must also have basic skills such as time management, self-regulation, self-efficiency, and teamwork, otherwise they will face challenges using the flipped classroom approach. Similarly, Yilmaz (2017) explains the importance when deciding on a new learning tool as it should cater for learners' abilities to use such tools and be successful. Additional challenges identified were technical issues and costs. According to Roehl et al. (2013), it is imperative to recognise financial limitations when introducing blended learning using the flipped classroom approach. These limitations can affect teachers, learners, and public institutions having limited financial resources. Access to the internet and computers outside of classrooms is central to the success of the strategy. In this study, learners who tried to implement the strategy often found it difficult due to a lack of financial resources, which could have had a more significant impact on this study's findings. A similar study is needed where participants do not lack the critical resources and have more significant support from the institution where findings can be compared.

Garrison and Vaughan (2008) explain there is a correlation between teaching, social and cognitive presence. Through these presences of practice, understanding and collaboration are seen as methods through which active learning can occur. This corresponds with the findings in this research. The learning for each participant was improved through personal experimentation with this strategy which improved social interaction with other participants and the lecturer.

With the use of the blended approach, it is understood that interaction between lecturer and learner improves (Garrison & Vaughan, 2008), and this improvement impacts learning activities that are chosen to be used as tools of engagement in the face-to-face lesson and online platforms. Nguyen (2012) and Roehl et al. (2013) contend that this interaction allows learners to express their understanding and knowledge in the classroom while asking better quality questions and thinking more deeply about the content creating active learning activities. Similarly, Moore (2005) argue that learner and teacher engagement in flipped classrooms is

significantly increased, resulting in greater one-on-one sessions to support improved cognitive demand; classwork and improved homework completion, and most significantly, the learner who did not do the online task still had the opportunity to work with friends in class to understand and catch up without being severely disadvantaged and vice versa. Moore et al's. (2014) findings also resonated with the findings of this study. Collaboration and its benefits were found throughout this study but more evident in the survey's open-ended questions and focus group discussions. However, while data showed this vast improvement, individual learning was impacted by the numerous challenges faced during teaching and learning and should be looked at in greater detail in future studies to improve vocational education at TVET colleges.

Teaching practice influenced blended learning with a flipped-classroom approach also emphasised learning activities. Garrison and Vaughan's (2008) explanation of the teaching presence supports this statement. With the lecturer's introduction of new teaching concepts and strategies, the learners still have to acknowledge and show a willingness to learn with them. As a result, teaching presence works closely with learning practices. Numerous challenges can affect these processes, and lecturers must ensure due diligence before implementing this learning system. Similarly, McGivney (1993, as cited in Callan et al., 2015, p.297) explains the challenges to teaching, which include:

situational factors (e.g., the ease of use of a new technology, lack of money to purchase equipment, lack of time); institutional practices and procedures (e.g., rules about evidence, assessment practices); and dispositional issues (e.g., attitudes of learners, teachers, and employers).

Garrison and Vaughan (2008) explain there is a connection between teaching and cognitive presence. These presences encourage selecting content and supporting discourse. This was evident in the findings of this research study. Learners explained the flexibility gained from this strategy allowed them to choose what, when, and how to learn, supporting selection of content. Likewise, being able to have a discussion with everyone participating in this study strengthened the idea of supporting discourse.

5.3 Summary of findings

This study found that blended learning and a flipped classroom approach **promoted flexible learning**. This was outlined in numerous responses, where learners explained how they liked the freedom to choose what to learn and when to learn. Another added benefit was the flexibility of learning at home and still being able to communicate with the lecturer and fellow

classmates. While learning with technology can be described as an individual task, it is dependent on several factors. These factors can include personal knowledge, life experiences, personal motivation, and available resources (Bliuc et al., 2012; Boyle et al., 2003). Blended learning models should bring all these qualities to the teaching environment creating a flexible learner-centred experience.

Blended learning and a flipped classroom approach **enhanced collaboration and collaborative learning of both lecturer and learners**. Findings show increased interaction between learners and their fellow peers, when working on online activities and in preparation for face-to-face instruction. The WhatsApp platform gave all learners access to difficulties and challenges other learners faced, while also allowing them accessibility to possible solutions being discussed on the platform. Learners also interacted and directed questions more comfortably towards the lecturer on the online platform, improving collaboration between the lecturer and learners on the group chat. However, collaborating with others shows that the quality of the learning and understanding can be improved considerably (Boyle et al., 2003; Bliuc et al., 2012). On the other hand, while some learners were still not comfortable asking the lecturer questions on the group chat, they still had the option to chat with him privately on the online platform.

Blended learning and a flipped classroom approach **resulted in improved understanding and self-development**. From the analysis of data, a difference with the learners' responses and learning was evident when comparing cycle one and cycle two. At the end of cycle one, learners were already making suggestions' on how to improve their learning and understanding using this strategy by changing how and when they received online content. This showed how teaching and learning was moving more towards a learner-centred approach. Learners were taking responsibility, initiative and playing a more active role in their own learning. As a result, of learner feedback being implemented, the improvement in learning and understanding was evident in cycle two. Learner-centred activities should be the end goal when choosing to apply blended learning strategies. Learners also need to be motivated with the ability to think and work outside norms. While learning with technology can be described as an individual task, it is dependent on several factors. These factors can include personal knowledge, own life experiences, personal motivation, and available resources (Boyle et al., 2003; Bliuc et al., 2012). Blended learning models should bring all these qualities to the teaching environment creating a learner-cantered experience.

Blended learning and a flipped classroom approach **offered safety to teachers and students during the Covid-19 pandemic**. One of the key points from learner feedback and analysis of data was the ability to learn in a safe environment during the Covid-19 pandemic. The flexibility afforded to learners by using this strategy, ensured learners were still able to continue with their learning from a place of safety during the Covid-19 pandemic. From learners' responses this was not the case with the rest of their subjects, as learning ceased to a halt during level five of the lockdown.

Blended learning and a flipped classroom approach were **compromised due to challenges related to connectivity, lack of resources and the Covid-19 pandemic**. This was an important key point from analysis of data, showing that learners felt deeply aggrieved not having proper resources to continue their learning without interruptions. Not having sufficient data to watch and download from online platforms and not having hardware to watch and learn from the online content were key talking points among learners. It must also be noted that these challenges also forced learners to collaborate and work with others more than they would have normally done. However, while learners did make alternate plans to ensure their work was up to date and unaffected, they did make it known, how they have felt let down by the campus and institution during a critical time in their learning. The online and digital tools available to learners, the support structures in place for learners and lecturers, and the buy-in from learners play a significant role in this approach's success (Boelens et al., 2017).

The data analysed from each collection tool supports the findings of the other tools used. This was evident in the questionnaire and observation tool using quantitative data, where data from cycle one was more negative while data from cycle two improved considerably towards more positive responses. Likewise, the qualitative data obtained from the survey and focus group resulted in similar themes and concepts. The final three themes that emerged from the survey also emerged as themes in the focus group discussions. This helped show consistency in the data and findings. With the quantitative data clearly showing learners' progress, the qualitative data gave more insight into why. The quantitative data helped support the findings of the qualitative data.

When applying the data analysis and the findings from this study, the research question is answered, and it can be concluded that learners' understanding and learning in basic electronic tools and measuring equipment at this TVET College was enhanced using blended learning with flipped classroom strategy. My teaching practice of basic electronic tools and measuring equipment also improved as a result of conducting this action research study.

5.4 Recommendations for further research

Some recommendations for further research were highlighted in the previous discussion. The study focused mainly on the enhancement of students' understanding in Electronic Control & Digital Electronics at a TVET college. The study could be extended to involve lecturers' experiences of the flipped classroom approach over a longer period of time. A comparative study could also be conducted to learn from what other lecturers in other subjects are doing to engage learners in similar contexts.

5.5 Limitations of the study

The type of learners, the specific module of curriculum used, online platforms lecturers may choose to use, resources available, and conducting the research during a pandemic could all be areas that could impact findings of future research studies adopting blended learning using a flipped-classroom approach at a TVET college. Learners' initial mindset and the lack of buy-in to this new strategy during cycle one was a factor that could have hindered the learning in this strategy. Learners also showing reluctance to collaborate and express themselves was another factor. Secondly, learners were challenged to adapt and learn during the Covid-19 pandemic and while it may have highlighted the importance of online and flexible learning, one must not rule out the stress it placed on learners and teaching staff. Lastly, the most significant factor that emerged as a challenge was the lack of critical resources and support from the institution needed for effective online learning.

5.6 Conclusion

The purpose of this study was to examine how blended learning using the flipped classroom approach enhanced student learning in Electronic Control and Digital Electronics at a TVET College. The purpose of this action research study was also to improve my teaching practice of basic electronic tools and measuring equipment. It can be concluded that both the aims of this study were achieved. This study strengthened the evidence that learning is an individual process that can be strengthened and weakened by internal and external factors. The community of inquiry framework helped identify indicators and factors which are most relevant when using any blended approach. Likewise, its relevance to identifying the learner-centred approach is vital to the use of this strategy for this study. Moving towards a more

learner-centred approach at TVET colleges is more likely to provoke disputes among the teaching fraternity as a teacher-centred approach is currently still the method of choice. This study allowed learners to take charge and control their learning through exploration and experimentation. The challenges expressed by learners during this strategy will require deeper reflection and more significant research to understand the learner-centred approach's efficacy. It can be argued that TVET institutions should assist lecturers in developing more learner-centred strategies to encourage active learning despite the limited resources and funding. It can thus be concluded that the flipped classroom approach is one such pedagogical strategy that allows learners to exercise all their cognitive levels, which is needed in preparation for the technical workforce South Africa currently lacks and TVET colleges are mandated to provide.

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Appendix 1: Letter to Campus Manager

33 Leinster Road
Woodbyrne
Scottsville
3201
3/06/2019

Dear Sir/Madam

My name is Thirushen Odayar (Student No. 203506479) a Master of Education (MEd) student in the School of Education at the University of KwaZulu-Natal (Pietermaritzburg campus). As part of the requirement for this degree, I am required to conduct a research project. The title of my research study is “Using flipped classroom strategy to enhance engineering student’s learning of Basic electronic tools and measuring equipment in a vocational setting”. The aim and purpose of this research study is to examine: “The use of flipped classroom as a strategy in enhancing student’s learning of Basic electronic tools and measuring equipment in Electronic Control and Digital Electronics level 2 at a TVET college.” I request your assistance in this research project by being granted permission to conduct my study in your institution. This study is expected to use of participants who are learners in level 2 in your college and will involve the following procedures. Participants will be observed during lessons as a data generation method. They may also be required to complete questionnaires or participate in semi- structured interviews that are expected to last between 20 to 40 minutes at a time suitable to them which will not disturb teaching and learning. Follow-up interviews may be conducted if necessary. Each interview will be voice-recorded. The duration of their participation if they choose to participate and remain in the study is expected to be 6-10 weeks.

This study will not involve any risks and/or discomfort for the school and participants. Also, the study will not provide direct benefits for the school or participants. I will be implementing a new teaching strategy as an intervention which could assist participant’s learning and understanding.

In the event of any problems or concerns/questions you may contact me, my supervisor or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

My contact number

Email: thirushen.odayar@gmail.com Cell: 0844006011

Supervisor

Dr J. Naidoo Email address: naidooj@ukzn.ac.za Telephone 033 260 5867

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Participation in this research study is voluntary and participants may withdraw participation at any point. In the event of refusal/withdrawal of participation the participants will not be penalised. There are no consequences for participants who withdraw from the study.

No costs will be incurred by participants as a result of participation in the study and there are no incentives or reimbursements for participation in the study.

All names of schools and participants will be changed, and pseudonyms will be used so that schools and participants remain anonymous. Information provided by participants will remain confidential and will not be shared with anyone else. Data generated through lesson observations, questionnaires and/ or semi-structured interviews will be stored in my supervisor's office, at the School of Education, Pietermaritzburg campus for five years, and thereafter be destroyed.

Thank you for your cooperation.

Yours in Education

Mr Thirushen Odayar

DECLARATION OF CONSENT

I _____ (Full names of the campus manager) have been informed about the study entitled: "Using flipped classroom teaching strategies to enhance engineering student's learning of basic electronic tools and measuring equipment in a vocational setting" by Thirushen Odayar.

I understand the purpose and procedures of the study.

SIGNATURE OF CAMPUS MANAGER

DATE

Appendix 2: Letter to Participant

33 Leinster Road
Scotsville
Pietermaritzburg
3201
3/6/2019

Dear Sir/Madam

REQUEST FOR PARTICIPATION IN RESEARCH PROJECT

My name is Thirushen Odayar (Student No. 203506479) a Master of Education (MEd) student in the School of Education at the University of KwaZulu-Natal (Pietermaritzburg campus). As part of the requirement for this degree, I am required to conducting a research project. I request your assistance in this research project by being granted permission to conduct my study using your child as a participant OR I request your participation in this research study. The tittle of my study is: “Using flipped classroom strategy to enhance engineering student’s learning of Basic electronic tools and measuring equipment in a vocational setting.” The aim and purpose of this research study is to examine: To what extent does “The use of flipped classroom as a teaching strategy in enhancing student’s learning of Basic electronic tools and measuring equipment in Electronic Control and Digital Electronics level 2 at a TVET college.” This study is expected to use participants who are learners in level 2 and will involve the following procedures. As participants, you will be observed during lessons as a data generation method. You may also be required to complete questionnaires or participate in semi- structured interviews that are expected to last between 20 to 40 minutes at a time suitable to you which will not disturb teaching and learning. The duration of your participation if you choose to participate and remain in the study is expected to be 6-10 weeks. This study will not involve any risks and/or discomfort to yourself. Also, the study will not provide direct benefits for learners. I will be implementing a new teaching strategy as an intervention which could assist in learner’s learning and understanding. In the event of any problems or concerns/questions you may contact me, my supervisor or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

My contact number

Email: thirushen.odayar@gmail.com Cell: 0844006011

Supervisor

My supervisor is Dr J. Naidoo who is located at the School of Education, Pietermaritzburg campus of University of KwaZulu-Natal.

Telephone 033 260 5867, Email address: naidooj@ukzn.ac.za

UKZN Research Office

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Participation in this research study is voluntary and learners may withdraw participation at any point. In the event of refusal/withdrawal of participation learners will not be penalised. There are no consequences for learners if they withdraw from the study.

No costs will be incurred by learners as a result of participation in the study and there are no incentives or reimbursements for participation in the study.

All names of schools and participants will be changed and pseudonyms will be used so that schools and participants remain anonymous. Information provided by learners will remain confidential and will not be shared with anyone else. Data generated through lesson observations, questionnaires and/ or semi-structured interviews will be stored in my supervisor's office, at the School of Education, Pietermaritzburg campus for five years, and thereafter be destroyed.

Thank you for your cooperation.

Yours in Education

Thirushen Odayar

DECLARATION OF CONSENT

I, _____ (Name of parent/guardian/learner) have been informed about the study entitled: "Using flipped classroom teaching strategies to enhance engineering student's learning of basic electronic tools and measuring equipment in a vocational setting" by Thirushen Odayar

I understand the purpose and procedures of the study.

I have been given an opportunity to ask questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at (provide details).

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557 - Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Additional consent, where applicable

I hereby provide consent to: (Please circle response)

Observe lessons and classroom activities YES / NO

Audio-record my interview / focus group discussion YES / NO

Complete questionnaires YES / NO

Signature of Participant

Parent/ Guardian

Date

Appendix 3: Ethical Clearance



03 April 2020

Mr Thirushen Odayar (203506479)
School Of Education
Pietermaritzburg Campus

Dear Mr Odayar,

Protocol reference number: HSSREC/00001061/2020

Project title: Using a flipped classroom strategy to enhance engineering students' learning of Basic electronic tools and measuring equipment in a vocational setting

Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 25 February 2020 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 03 April 2021.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dd

Humanities & Social Sciences Research Ethics Committee
UKZN Research Ethics Office Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Tel: +27 31 260 8350 / 4557 / 3587
Website: <http://research.ukzn.ac.za/Research-Ethics/>

Founding Campuses: ■ Edgewood ■ Howard College ■ Medical School ■ Pietermaritzburg ■ Westville

INSPIRING GREATNESS

Appendix 4: Observation Schedule

Criteria	Outstanding (4)	Highly Competent (3)	Competent (2)	Not Achieved (0-1)
(A) Selection and use of tools				
1. Selection of tools				
2. Use of tools				
3. Housekeeping				
4. Selection of hand tools				
5. Use of hand tools				
Subtotal A (20)				
(B) Identification of components and materials				
1. Identification of components as per diagram				
2. Identification of material as per diagram				
Subtotal B (8)				
(C) Arranging components on planning sheet				
1. As per circuit diagram				
2. Planning				
3. Short circuits				
4. Component polarity				
Subtotal C (16)				
(D) Implementation and layout of components				
1. Arrangements of components on breadboard				
2. Laying of components on breadboard				
3. Observation of polarity				
4. Bending of components				
5. Soldering				
6. Trimming of leads				

Subtotal A (24)				
(E) Overall impression of completed task				
1. Functionality of task				
2. Presentation of task				
3. Interpretation and analysis of circuit diagram				
Subtotal C (12)				
Final Total	/80			
Percentage value				

Appendix 5: Student Survey

Student Survey of Lesson and Teacher:

ECDE Level 2: 2020

Date:

The purpose of this survey is to allow you to give feedback to the teacher on how this class and lesson can be improved.

You are encouraged to add your comments and suggestions on question 21 to 26 on this survey, where possible use your own experience to explain. Please tick an option provided once.

For this module on basic electronic tools and measuring equipment,	Yes	Sometimes	No
1. Did the lecturer clearly explain the objectives, requirements and grading of this module and its units?			
2. Did the lecturer make use of various teaching methods (hands on, written, group and orally, social media platform)?			
3. Did the lecturer provide opportunities for student feedback?			
4. Did the face-to-face lessons encourage learners to think for themselves?			
5. Did the lecturer make the lesson interesting and relevant?			
6. Was the lecturer approachable and willing to help you?			
7. Did the lecturer know the subject matter?			
8. Did the lecturer enforce rules fairly and consistently?			
9. Did the lecturer use humour effectively when teaching?			

10. Did the lecturer create an environment that assists learning?			
11. Did online learning assist your face-to-face learning?			
12. Did the teacher keep you informed about your failures or progress during the lessons?			
13. Was the online learning better than the classroom?			
14. Would you prefer more online learning?			
15. Would you prefer more classroom learning?			
16. Was being able to see the online videos first, then touch and place components on the breadboard beneficial to your understanding and learning of this module?			
17. Did you understand this module better with the new teaching strategies introduced?			
18. Would you prefer this type of teaching for the entire syllabus?			
19. Did the face-to-face lessons give you positivity towards passing this module?			
20. Do you think the teacher need to make improvements in the way he teaches?			

21. Is there anything about the blended learning using the flipped classroom approach that frustrated you? Give Examples

22.What did you like best about the new strategy? Give Examples

23.What do you think can be done to improve this form of learning? Give examples

24. Is there anything about the lessons or classroom environment that frustrates you? Explain

25. What did you like best about the face-to-face lessons? Give clear examples

Appendix 6: Focus Group Discussion

Focus Group Discussion:

Welcome and thank you for agreeing for being a part of this focus group. I appreciate your willingness to participate. The reason we are here today, is to get clarity and more information about your personal experiences when using blended learning in your module for Electronic Control & Digital Electronics (ECDE) level2. I encourage you to share your honest and open thoughts with me.

Ground Rules:

1. I WANT YOU TO DO THE TALKING. I would like everyone to participate. I may call on you if I haven't heard from you in a while.
2. THERE ARE NO RIGHT OR WRONG ANSWERS Every person's experiences and opinions are important. Speak up whether you agree or disagree. I want to hear a wide range of opinions.
3. WHAT IS SAID IN THIS ROOM STAYS HERE I want you to feel comfortable sharing when sensitive issues come up.
4. I WILL BE TAPE RECORDING THE GROUP I want to capture everything you have to say. I don't identify anyone by name in my report. You will remain anonymous.

Questions:

1. Has blended learning in this module had a positive or negative effect on your learning and can you explain giving details the reason for your answer?
2. What do you believe were the benefits of using blended learning in this module?
3. What do you believe were the challenges of using Blended learning in this module?
4. How did blended learning improve your learning personally?
5. Did you prefer the face to face lessons or the online components of learning and why?
6. Do you have any suggestions and ideas on how we could further improve this mode of learning in ECDE level2

Appendix 7: Learner Questionnaire

Learner perceptions of the flipped classroom

Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. The flipped classroom is more engaging than traditional classroom instruction					
2. The flipped classroom increased my communication with others in the class					
3. I am more motivated to learn ECDE in a flipped classroom					
4. I prefer watching lessons on videos					
5. I find it easy to pace myself through the work					
6. The flipped classroom would be useful in my other subjects in this course					
7. The flipped classroom has improved my learning and understanding of this module					
8. There were more benefits of using the flipped classroom in this module					

9. There were more challenges using the flipped classroom					
10. I have a greater chance of passing this module because of the flipped classroom					

Appendix 8: Editing Certificate



8th July 2021

To whom it may concern

EDITING OF DISSERTATION FOR MR THIRUSHEN ODAYAR

I have a master's degree in Social Science, Research Psychology and a TEFL qualification from UKZN. I also have an undergraduate and honour's degree Bachelor of Arts in Health Sciences and Social Services from UNISA.

I have 15 years of teaching experience and have been editing academic theses for students from UKZN, UNISA, the University of Fort Hare, and DUT for the past eight years. I have further undertaken editing, transcribing and other research work for private individuals and businesses.

I hereby confirm that I have edited Thirushen Odayar's dissertation titled **"Blended Learning and Flipped Classroom Approaches as Learning strategies in Electronic Control and Digital Electronics at a Technical and Vocational Education Training Institution"** for submission of his Master of Education in Teacher Development Studies at the University of KwaZulu-Natal. Corrections were made in respect of grammar, tenses, spelling and language usage using track changes in MS Word 2013. Once corrections have been attended to, the dissertation should be correct.

Yours sincerely



Terry Shuttleworth (Hons BA Psych Coun, UNISA; TEFL, UKZN; MSocSc, UKZN).

DISCLAIMER

Appendix 9: Turnitin

