



# **Investigating the Impact of Using an Active Pedagogic Approach to Teaching with Technology on Student Learning**

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## ABSTRACT

The use of technology in the classroom has been a topic of debate for many years. Several researchers have done much work on how best technology can be integrated successfully into the classroom. Some argue that technology can be a valuable tool for enhancing student learning, while others believe that it can be a distraction and lead to decreased engagement. Research has made it clear that using an active learning approach to teaching and learning might make the results a bit more positively predictable. This study investigated the impact of using an active pedagogic approach to teaching with technology on student learning at a primary school in Nigeria.

This study is a case study that made use of action intervention research, passing selected participants through seven weeks of teaching using the Activated Classroom Teaching (ACT) model as the intervention. The ACT model is an active learning pedagogical approach that passes students through six layers of increased activities – consumption, curation, conversation, correction, creation and chaos, ensuring student engagement. This study used a mixed method approach and so data was collected from a sample of 91 students through a questionnaire and 4 teachers through a focus group discussion. Secondary data as well as scores from teacher-made tests were also collected to add robustness to the data. Quantitative analysis was done using SPSS, with other statistical tests and t-tests carried out as well. Qualitative analysis was done as the FGD was transcribed, coded and major themes were derived and discussed.

The findings of this study suggest that using an active pedagogic approach to teaching with technology, such as the ACT model, can be an effective way to increase student engagement and academic performance, thereby enhancing student learning. Specifically, results revealed that the ACT model has a positive impact on the affective engagement and academic performance of students. Although students have high behavioural and cognitive engagement, there is a slight decrease in these engagement parameters for the students. Furthermore, the ACT model provides a pedagogical framework for teachers to use technology in a way that engages students and promotes deep learning.

This study contributes to the body of knowledge by providing evidence that using an active pedagogic approach to teaching with technology can be an effective way to increase student engagement and academic performance. Additionally, it provides valuable insights for teachers who are considering using technology in their classrooms and suggests that for teachers to teach effectively with technology and get the desired results, they must be trained to engage the affordances of technology and teach using an active pedagogical approach.

## DECLARATION

I, Daniel Obatomisin Adeboye (215079532), declare that

- i. The research reported in this thesis, except where otherwise indicated, is my original research.
- ii. This thesis has not been submitted for any degree or examination at any other university.
- iii. This thesis does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from other persons.
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## DEDICATION

This thesis is dedicated to my parents and disciplers, Pastor & Pastor (Mrs) Lanre and Yinka Adeboye. They have taught and shown me by life that this strait way of following Jesus, is not just right, it's better.

## ACKNOWLEDGEMENT

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

4IR	4 <sup>th</sup> Industrial Revolution
5IR	5 <sup>th</sup> Industrial Revolution
ACT	Activated Classroom Teaching
AI	Artificial Intelligence
EdTech	Educational Technology
FGD	Focus Group Discussion
HOTS	Higher Order Thinking Skills
IBL	Inquiry-based Learning
LMS	Learning Management System
NLP	Natural Language Processing
PBL	Problem-based Learning
SPSS	Statistical Package for the Social Sciences

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Research Background and Need

The use of technology for teaching and learning has been growing rapidly in recent years. This is due to a number of factors, including the increasing availability of technology, the decreasing cost of technology, and the growing recognition of the benefits of technology-enhanced learning (Denton, 2022).

One of the key benefits of technology integration is its potential to improve student engagement. When students are engaged in their learning, they are more likely to be motivated, to pay attention, and to retain information. There is a growing body of research that supports the claim that technology can help to improve student engagement. For example, a study by Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt and Wenderoth (2014) found that students who used technology in their learning were more engaged than those who did not.

Another key benefit of technology integration is its potential to improve academic performance. When students are able to use technology to access information, collaborate with others, and create their learning materials, they are more likely to achieve at high levels. There is also a growing body of research that supports the claim that technology can help to improve academic performance. For example, a study by Clark (2014) found that students who were taught using technology-enhanced learning methods outperformed those who were taught using traditional methods.

In Nigeria, there is a growing interest in the use of technology for teaching and learning. Aduwa-Ogiegbean and Iyamu (2005) researched the use of ICT for teaching and learning purposes in Nigerian secondary schools. After the COVID-19 pandemic, several other researchers have researched the use of online learning platforms for teaching and learning purposes, among university students (Aduba & Mayowa-Adebara, 2022). However, there are also a number of challenges that need to be addressed in order to ensure that technology is used

effectively to improve student engagement and academic performance. One of the key challenges is the lack of infrastructure (Anene, Imam, & Odumuh, 2014). Many schools in Nigeria do not have access to stable internet or computers (Adeoye, Adanikin, & Adanikin, 2020). Even in cases where these exist, there is still a divide between those who can afford it and those who cannot. This makes it difficult to engage fully with the powers of technology-enhanced learning methods.

Another challenge is the lack of teacher training. As seen in the study by Owolabi, Oyewole and Oke (2013), even though teachers are quite comfortable with using technology in their personal day-to-day lives, many teachers in Nigeria are not familiar with how to use technology effectively in the classroom. Unfortunately, previous efforts to train teachers have been attempted by technology companies and agents rather than educational technologists (Ololube, 2015). This only increased general technology proficiency and not necessarily the ability to teach effectively with the technology. This makes it difficult for these teachers to integrate technology into their teaching and learning practices.

Despite these challenges, there is a growing movement in Nigeria to use technology to improve education (Adeoye et al., 2020). There are a number of initiatives underway to provide schools with access to technology and to train teachers on how to use technology effectively. As these initiatives continue to develop, the use of technology for teaching and learning will likely become more widespread in Nigeria (Egielewa, Idogho, Iyalomhe, & Cirella, 2022).

This research, however, investigated the impact of using an active pedagogic approach to teaching with technology on students' engagement and academic performance at a primary school in Nigeria. It sought to discover what impact using an active learning approach, like the Activated Classroom Teaching (ACT) model has on student engagement and academic performance, at a primary school.

## **1.2 Research Problem**

In this 21st century, there is an increase in the use of technology in the education sector. Particularly, in light of the recent COVID-19 pandemic and its effect on teaching and learning,

many schools are jumping onto the bandwagon of integrating technology into their teaching and learning practice; however, there is a noticeable problem.

Carter, Greenberg and Walker (2016) reported that having computer devices in the classroom “has a substantial negative effect on academic performance”. Mueller and Oppenheimer (2014) also reported that students who were allowed to use tablets and laptops in the classroom were not as effective in note-taking and had more distractions than those who didn’t. Furthermore, a Duggan and Brenner (2013) research survey revealed that teachers believed that digital technologies in the classroom were producing a generation that is easily distracted and has a short attention span. About 50% of the teachers in that survey believe that these digital technologies are hurting critical thinking and the ability to communicate face-to-face.

Further reports show that even though schools in this period are attempting to teach online using technology, it has been very difficult to keep the students engaged (Todd, 2020). There have been more distractions and problems with teaching and learning online with technology than existed in the pre-Covid era. As reported by Egielewa et al. (2022), several Nigerian students who are struggling to learn online with technology have been very bored simply watching videos. As reported by a student “I stopped downloading the videos because they were not only very heavy but long and boring”. This research showed that students are not in favourable support of teaching and learning online; in fact, they want to return to the old method of traditional classroom teaching (Egielewa et al., 2022).

Conversely, other results have shown the positive impact of technology devices in the classroom. About 75% of teachers reported that the internet and technology as a whole have a positive impact on the research skills of students and, thereby, increase their academic performance (Freeman et al., 2014). Furthermore, 84% of teachers are already using some form of technology in their lesson plans and have recorded an increase in student performance (TES, 2016). Results of research carried out by Clark (2014) in a secondary school mathematics class, showed that there is an increase in the engagement and communication of students while using technology as compared to a traditional classroom.

Teachers who have been able to adopt technology have been able to keep on teaching despite the interruption that COVID-19 brought. Technology made teaching and learning possible

despite the inability of students to meet physically (Megahed & Hassan, 2022). Whereas students were bored in the conventional classroom, they are more engaged in learning. Teachers that used videos and other technology tools to teach during this period increased their retention rate and so increased the academic performance of the students (Aduba et al., 2022).

The conflicting results, some indicating that technology has a positive effect on teaching and learning and others showing the opposite, have caused confusion (Johannessen, Rasmussen, & Haldar, 2023). Teachers are left unsure of how to proceed while researchers are polarized in their views. In Nigeria particularly, many school leaders have been sceptical about the introduction of technology due to these conflicting results (Kanbul, Adamu, Usman, & Abba, 2022). Schools that are embracing technology, are yet having disengaged students and this might be due to a lack of an active pedagogy.

Summarily, the research statement of the problem is:

*There are conflicting results on the impact of technology on teaching and learning causing teachers and school leaders to be unsure and sceptical about the introduction of technology.*

This research, therefore, studied the impact of using an active pedagogic approach to teaching with technology on student learning at a primary school in Nigeria. It helped to discover what impact using an active learning approach like the Activated Classroom Teaching (ACT) model will have on the classroom engagement and academic performance of primary school students. This study also helped to unveil how the ACT model enhances student learning.

### **1.3 Research Gap and Rationale**

As we ease into the post-Covid era, educational institutions have been forced to adopt technology for teaching and learning purposes. As seen in Megahed et al. (2022), schools around the world have had to adjust their teaching method to include learning approaches that involve some form of technology. Despite the research that presents the negative impact of technology on teaching and learning, Covid has made it almost impossible for schools to teach without using technology, or risk losing students.

Therefore, several schools have been thrown into a frantic effort to survive (Megahed et al., 2022). Several schools have had to find ways to adapt to the changing educational scenes by throwing lots of technology into the classroom. Technology tools ranging from whiteboards to tablets and laptops have been introduced into the classroom just to ensure that learning continues to take place despite the difficulties introduced by Covid (Muhammadqosimovna & Satvoldiyevna, 2022). However, many are doing this blindly, without following a particular pedagogy of learning which is the major cause of the failures with technology that is facing the schools.

In previous studies like that of Lin, Lu, Chung and Yang (2010) and Chilwant (2012), conventional pedagogies of learning have been used, many of which do not take into cognizance the input of technology. Pedagogies like behaviourism, constructivism, social constructivism, inquiry-based learning, reflective learning etc. though effective in transforming how students learn, are not based on technology and so are limited in the way they help digital natives, who are technology addicts, (Xavier, Farbiarz, & Farbiarz, 2020) learn.

#### **1.4 Purpose of the study**

The purpose of this research was to investigate the impact using an active pedagogic approach to teaching with technology would have on student learning. The study examined the impact the Activated Classroom Teaching (ACT) pedagogy would have on student engagement and academic performance. Furthermore, the study dived into the different layers of the Activated Classroom Teaching (ACT) pedagogy and shows how it impacts affective, behavioural and cognitive engagement, which are parameters for measuring student engagement; as well as the academic performance of students at a primary school in Nigeria. This research also sought to discover how the ACT model enhances how students learn in and out of the classroom.

#### **1.5 Research Objectives**

The following are the specific objectives for carrying out this research:

1. To discover the impact of using the ACT model on student affective engagement;

2. To discover the impact of using the ACT model on student behavioural engagement;
3. To discover the impact of using the ACT model on student cognitive engagement;
4. To discover the impact of using the ACT model on student academic performance; and
5. To discover how the ACT model enhances student learning.

## 1.6 Research Questions

In order to achieve the research objectives stated above, the following critical research questions guided this study:

1. What is the impact of using the ACT model on student affective engagement?
2. What is the impact of using the ACT model on student behavioural engagement?
3. What is the impact of using the ACT model on student cognitive engagement?
4. What is the impact of using the ACT model on student academic performance?
5. How does the ACT model enhance student learning?

## 1.7 Research Hypotheses

This section discusses the hypotheses used to study the impact of using the ACT pedagogies on student engagement and academic performance. There are two groups of hypotheses stated. The first group focuses on the direct relationship between the ACT model and the parameters for measuring engagement. The second group of hypotheses focuses on the relationship between the ACT model and the academic performance of the students.

### *1.7.1 ACT model and Affective Engagement*

Affective engagement is defined as the students' feelings towards their school, teachers, peers and learning (Hart, Stewart, & Jimerson, 2011a). This has to do with how much the students feel a sense of belonging to the school and to learning all together. Given the above, the hypothesis below was postulated:

*H1-a1: The ACT model will have a positive impact on the affective engagement of the students after the intervention.*

### ***1.7.2 ACT model and Behavioural Engagement***

Behavioural engagement focuses on the acceptable conduct of the students and how much they obey the rules of the school. According to Alrashidi, Phan and Ngu (2016), it also measures the efforts and persistence of students in class activities and tasks as well as school-wide activities. Therefore, the hypothesis below was postulated:

*H1-a2: The ACT model will have a positive impact on the behavioural engagement of the students after the intervention.*

### ***1.7.3 ACT model and Cognitive Engagement***

Cognitive engagement has to do with the perceptions of students to learning and how much students are willing to work hard. It deals with the tenacity of students to solve problems, work hard and have a positive attitude to failure (Skinner, Kindermann, Connell, & Wellborn, 2007). Therefore, the researcher hypothesized that:

*H1-a3: The ACT model will have a positive impact on the cognitive engagement of the students after the intervention.*

### ***1.7.4 ACT Model and Academic Performance***

Research has shown that one of the major success factors for student learning is academic performance (Brame, 2017). This means that if students perform well in their studies, it means that learning has successfully taken place. The ACT model was employed in the teaching of the students and their performance was observed both before and after the intervention of the model.

Furthermore, the engagement of students as discussed above and the academic performance of the students are the parameters used to measure student learning. If these factors are in place, it means that the students are successfully learning.

Therefore, to understand this properly, the hypothesis below was postulated:

*H1-a4: The ACT model will have a positive impact on the academic performance of the students after the intervention.*

## **1.8 Limitations and Delimitations of the Study**

Despite the success of the study, this study has a few limitations and delimitations. These include limitations and delimitations around using only one active learning strategy, sampling method, data gathering method, number of subjects and duration of the study.

### ***1.8.1 Limitations of the study***

\* Respondents in this study were students of a primary school in Nigeria. Due to their age, some of the students left a few items in the questionnaire unfilled. Others filled wrongly by marking two options in a single question item.

\* Another limitation is the subjects used and the duration of the study. Only four subjects namely Mathematics, Verbal reasoning, French and Computer studies were used during the intervention and for seven weeks. It would have been interesting to see what the results would look like if this study was done with more than four subjects and over a longer period.

\* Another limitation of this study is that the study was carried out only in a primary school in Nigeria. This study has not taken into consideration what impact the ACT study would have on secondary students or tertiary students who are older and in other countries. It would be interesting to see if the results would be different across secondary or tertiary schools in Nigeria or in other African countries.

\* Another limitation was the sampling method used in this research. The purposive sampling technique limits the generalization of findings. Future studies can ensure the use of a probability sampling method so that the findings can be generalized.

### *1.8.2 Delimitations of the study*

\* The Activated Classroom Teaching model was chosen ahead of the other active learning strategies because the different pedagogical layers of the model take into consideration more recent affordances of technology integration in teaching and learning.

\* The study made use of the cross-sectional approach to research rather than the longitudinal method of gathering information since the researcher may not have the time and or get the same respondents when the study is repeated at another time. The sample involves students in the final year of their primary education.

## **1.9 Summary and Structure of Thesis**

This chapter provided an introduction to this research study on the impact of using the Activated Classroom Teaching pedagogy on student engagement and academic performance. The research problem, which is the converse results gotten from different studies was examined and discussed. The research gap and rationale were also considered which is what this study hopes to fill.

Furthermore, the research questions, objectives and hypotheses were stated clearly in this chapter. This research considered the impact of the activated classroom teaching model on student learning and academic performance in a primary school in Nigeria.

The theoretical and practical contributions of the study have also been considered as well as the limitations and delimitations of the study. Findings from the research show that there is a significant impact of the ACT model on student learning and academic performance. On the other hand, this study made use of only one active learning strategy, the ACT model on primary level 5 and 6 students only. The study was carried out over seven weeks using only four subjects.

Finally, this thesis has been structured into seven chapters as follows:

**Chapter One** presents the general introduction and background to the study. It discusses the research problem, research objectives, research questions and the limitations of the study.

**Chapter Two** presents a review of the existing literature on general teaching methods, active

teaching methods and technology-enabled active methods. It also reviews the history and trends of the industrial revolutions, Education 4.0 and Education 5.0 and how teachers must begin to adapt to these changes. Furthermore, it presented briefly the evolving trend of artificial intelligence and its impact on education. Finally, the chapter ended by examining past literature on the impact of technology on education.

**Chapter Three** focused on the theoretical and conceptual framework on which the study is built. It reviews the activated classroom teaching pedagogy and the various layers in it. It also offers a review of student engagement and the various parameters for measuring it and academic performance. The chapter ended by presenting a new conceptual framework which guided the study.

**Chapter Four** is devoted to the research methodology. It discusses the research design and method, sampling technique, data collection and survey development. This chapter also presents the data analysis method used for the study.

**Chapter Five** presents the research results. It presents the pre-intervention and post-intervention results of student engagement and academic performance. It also reveals the qualitative analysis of data using a code tree and word cloud.

**Chapter Six** presents a discussion of the results. It highlights major interpretations of key results and how it fits with the frameworks and existing literature. It also provides answers to the research questions earlier asked and hypotheses postulated.

**Chapter Seven** covers the conclusion and recommendations for further studies.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 What is Learning?

Learning extends far back before the beginning of school and has since had several definitions. Different researchers have tried to define what learning is and this definition has been reviewed and added to again and again as further research is done. To give us a foundation for our study, we shall examine a few definitions of learning as captured by researchers.

To start with, learning is the acquisition of information, skills, habits, knowledge and attitudes (Wahyuni, 2016). This begins from infancy to childhood and adulthood when humans acquire basic skills until they master them (GCWGandhinagar, 2007). Learning is not restricted to the domain of education as it can happen anywhere, anytime and in many different ways (Wahyuni, 2016). This continued capacity for individuals to pick things from the environment and develop their lifestyle is referred to as learning. Extending this definition, Wahyuni (2016) perceives learning as the processes that involve acquiring, mastering and building on the information and skills available for growth and development.

According to Anderson and Krathwohl (2001), learning refers to all the activities that make people observe, read, imitate and try to do something themselves. To him, learning involved what people acquire as they try to do something and experience something. This is further buttressed by Cronbach and Snow (1969) who defined learning as the change in behaviour that happens to a person as a result of experience. According to Taber (2009), students and teachers alike do not learn until they are allowed to do something with it or, better still, to teach it. This further confirms the definition of learning to involve experience. What is paramount to these researchers is that learning has to do with what a student can gain as he or she begins to do or experience something. Learning involves action (Adeboye, 2016); it involves doing something practical about whatever information has been acquired and until you do, you have not learnt.

Additionally, Cronbach et al. (1969) also suggested that for learning to take place, there must be a “change in behaviour”. So, while learning begins from acquiring competencies, skills and attitudes (Wahyuni, 2016), it must lead to a behavioural change. As we learn, we change the way we perceive and interpret our environment and, therefore, there is a change in how we interact and behave (AllPsych, 2014). According to this article, learning refers to the process that leads to a relatively permanent or potential behavioural change. “Relatively permanent” here suggests that once people learn something, some part of their brain changes to record what they have learnt and it is kept somewhere in their memory, even if they cannot immediately show it (Barsalou, 1999). It is also important to note that “Behaviour” is not limited to just physical activities but anything which the learner does, says, writes, thinks or feels (Church, 2015) and therefore, these changes in behaviour can be observed directly and publicly by the teacher.

As can be seen and in agreement with Pritchard (2009), learning is viewed differently by those who have spent time studying the subject and is characterized by several things. A close look into research sources reveals a range of different perspectives on the definition of learning, with varied emphasis. Table 2.1 summarizes a few of the definitions of learning as discussed in this section.

Table 2.1 Various definitions of learning according to literature

Author	Definition of learning
Wahyuni (2016)	Learning is the acquisition of information, skills, habits, knowledge and attitudes.
	Learning is the process that involves acquiring, mastering and building on the information and skills available for growth and development.
Anderson et al. (2001)	Learning refers to all the activities that make people observe, read, imitate and try to do something themselves.

Cronbach et al. (1969)	Learning is the behavioural change that happens to a person as a result of experience.
Adeboye (2016)	Learning involves doing something practical about whatever information has been acquired.
AllPsych (2014)	Learning refers to the process that leads to a relatively permanent or potential behavioural change.
Pritchard (2009)	Learning is the individual process of constructing understanding based on experience from a wide range of sources.
	Learning is the process of gaining knowledge through study.
	Learning is to gain knowledge of, or skill in, something through study, teaching, instruction or experience.

Summarily, for the purpose of this research, we will take learning to refer to the process which involves identification, reflection and implementation. It involves identifying new information, knowledge and skills, reflecting on and interpreting the content and practically doing something that causes a change in behaviour. The following sections will, therefore, examine from literature, the different learning approaches used in education. We would consider the major traditional learning approaches and some passive uses of technology in education, their success and their failures. We would also look at active learning and technology-enabled active learning approaches. We would examine the impact of COVID-19 on education and the introduction of e-learning in most educational institutions. Finally, we shall see from literature the fourth and fifth industrial revolutions and their impact on education.

## 2.2 Traditional Learning Approaches

For many decades, there have been several approaches to teaching and learning being employed in educational institutions (Graphy, 2022) and many researchers have studied the various learning approaches and theories. Traditional methods of learning are those that happen

within the four walls of a classroom and are focused on memorisation and rote learning (Masek & Yamin, 2012). The teacher speaks and gives notes while the student listens and copies the notes. Furthermore, the main source of information is gotten from the textbook, which students are expected to read and understand on their own. According to Serbessa (2006), traditional learning approaches are largely passive, as they do not engage the students in any active role. Students are made to sit through long hours of lectures without taking up any active role. Even though this may lead to a *quiet and controlled classroom*, it is counterproductive for learning (Bazelais & Doleck, 2018).

Some researchers have generally identified four learning theories namely behaviourism, cognitivism, constructivism and humanism (Waseem & Aslam, 2020). Other researchers (Fairbanks, 2021) also identified with these learning theories as different learning approaches. We shall attempt to consider these approaches in the sections below.

### ***2.2.1 Behaviourism***

Behaviourists equate learning with changes in the form or the frequency of observable performance (Waseem et al., 2020). Behaviourists focus on the importance of the consequences of these performances and they argue that reinforcement and motivation play an important role in causing repetition in the future. Teachers who teach following this approach recognise that their students would easily learn and even perform well if success is rewarded with praise, a badge or some form of positive reinforcement (Zhou & Brown, 2015). In this learning approach, students identify an expected change and repeat the behaviour when they get motivation from the teacher concerning that behaviour.

According to Gunnars (2021), one main strategy that behaviourists make use of is drills. Teachers can use daily or regular drills to help students appreciate the relationship between repetition, reinforcement and the appropriate behavioural change. Closely related to the strategy of drills, teachers can make use of positive reinforcement as another strategy for encouraging learning and ensuring a behaviour change (Gunnars, 2021). These reinforcements can range from simple praise of mouth to other forms of reward like gamification principles, added privileges and much more.

Gamification of learning according to Faiella and Ricciardi (2015) is the application of game principles to learning. It is taking elements of games that make it fun and interesting and applying them to learning. According to Apostol, Zaharescu and Alexe (2013), there are eight elements of games that are used for the gamification of learning. These game elements include rules, goals and outcomes, feedback and rewards, problem-solving, story, player, safe environment and sense of mastery. Furthermore, some of these could serve as extrinsic motivation like points, badges and stickers while the rest make for a deeper sense of autonomy and competence (Kapp, 2012). Teachers who teach using the behaviourism approach can give students stickers for every time a student answers a question correctly or points for every time a student scores above a particular score. This serves as positive reinforcement that helps every student strive to learn (Hinduja, 2021).

In a research carried out by Peel (2005), it was observed that teachers can also use guided practice and regular reviews as strategies. Behaviourists give students regular tasks and activities as practice and also help them review or go over what has been done to help students retain information learnt (Hinduja, 2021). This can be further helped by positive reinforcement anytime the students perform their activities as seen in figure 2.1.



Figure 2.1 Features of behaviourism learning theory (Cherry, 2018).

However, as great as this theory of learning is, there are some critics of this theory. The major one is that this theory of learning is not effective for analytical and comprehensive learning but can be used for learning foreign languages or mathematics (Gunnars, 2021). Strategies like drills, positive reinforcement, and guided practice are all useful for the learning of mathematics but would not be effective when students need to gain a deep understanding of concepts, analyse content and write down.

### ***2.2.2 Cognitivism***

Cognitivist learning theory refers basically to thinking about how we think. It is helping students think and reflect on what they're learning and how they understand it (Brayadi, Supriadi, & Manora, 2022). According to Hughes (2022), cognitive learning theory begins with learners taking in new information. This is followed by having them process it, which includes thinking about the information, interpreting it and storing it. Finally, cognitivists insist that the learner must respond and that the new information must lead to new behaviour (Hughes, 2022). Furthermore, according to Valamis (2022), cognitive learning helps students to learn how to maximize their brain's potential. This is done by helping them connect new information to existing ones thereby deepening their memory and retention capacity (Sriastuti & Masing, 2022).

As against older traditional learning methods that focus on memorisation only, cognitivists use the following to achieve deepened understanding: Comprehension, Memory and Application (Valamis, 2022). Comprehension is the phase in the cognitive process where the brain identifies new stimuli and tries to find relationships with existing information held in the brain. Before a student can process new information, it must be accurately comprehended (Hughes, 2022). At the memory phase of the cognitive process, students must retain the new information in the working memory before it is transferred to long-term memory. Cognitive learning theory discourages a learner from cramming information but rather encourages having a deep understanding of the subject by relating new information with previous information (Brayadi et al., 2022). The application stage of the cognitive process allows the learner to reflect on what has been learnt and the relationship with other information gotten. Teachers often assign tasks

to students to develop and deepen their problem-solving skills and solidify knowledge gotten (Hughes, 2022). Figure 2.2 summarises the cognitive learning loop.

Cognitivists can apply different strategies when teaching using the cognitive learning theory. One of these strategies is asking students questions and asking further questions. According to Malik (2021), this technique helps students to go deeper and seek further understanding of the concept as well as getting a deeper understanding of their thought process. For example, while teaching a topic “Materials” the teacher can ask what type of material paper is made of. This forces the students to think deeply about this and if someone mentions “wood”, the teacher can further ask what process wood must undergo to turn to paper. This further question will force the students to think again about the topic and deepen their overall understanding of the topic at hand (Faleh-Dr & Kazem, 2022). A corollary strategy is that of allowing the student to think aloud, either in one-to-one interactions, group projects or in classroom presentations (McNeil, 2023). Thinking aloud helps both the student and the teacher understand what goes on in the minds of the students and the thought process that produced the result. Another similar strategy used by cognitivists is self-reflection and self-questioning, where teachers give opportunity for their students to reflect and sometimes journal their reflections. According to Al-Shammari, Faulkner and Forlin (2019), this strategy is a simple but effective way to help students think about their thinking and understand their mental processes.

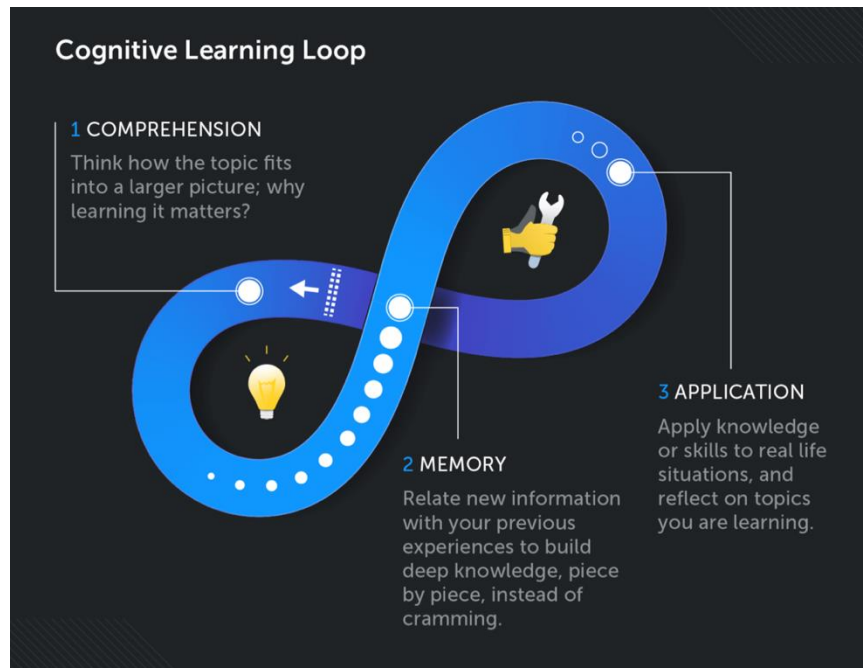


Figure 2.2 Cognitive Learning Loop (Valamis, 2022).

### 2.2.3 Constructivism

Constructivism is a theory of learning that is based on the idea that students or learners participate in their construction of learning based on what they have previously experienced and known (Bada & Olusegun, 2015). Constructivists postulate that learners build their knowledge by fitting new information into pre-existing knowledge. In this theory, learners actively construct their learning personally rather than passively listening to a teacher direct the learning. According to Ayaz and Sekerci (2015), knowledge cannot be imparted to the learners directly but teachers can create experiences and environments that make learners construct their knowledge. Therefore, teachers are not directly in control (Ayaz et al., 2015) of passing the information to the students, constructivists believe that teachers are simply facilitators of learning, where learners discover past personal experiences and build new information on it. This means constructivists believe that learning is personal (Semerci & Batdi, 2015) and that no two students learn in the same way. This is because the learners apply all new information to relevant, real-life scenarios they have personally experienced in the past.

Furthermore, according to Semerci et al. (2015), constructivist classrooms are more student-centred rather than teacher-centred with students being allowed to work in groups and not individually. Students are encouraged to interact together and work collaboratively on activities. This is sometimes referred to as social constructivism where learners build knowledge from how they interact and collaborate (University at Buffalo, 2019). In addition, just like in behaviourism, motivation is also important in students' ability to reach into their previous experiences and to make connections for new learning. Generally, students find it difficult to learn if they are not motivated so constructivist teachers must find ways to engage and motivate their students to get them to learn (Ayaz et al., 2015).

In the classroom, constructivist activities include inquiry-based learning (IBL), problem-based learning (PBL), cooperative learning and reciprocal learning (University at Buffalo, 2019). In inquiry-based learning, students are encouraged to create their questions and through research and observations, connections are made between pre-existing knowledge or schemas and the new knowledge received from the learning activity (Bada et al., 2015). The students can then draw conclusions and discover any remaining gaps in knowledge and ask further questions. This cycle continues and learning takes place. In problem-based learning, constructivists provide real-world problems and scenarios that require students to work collaboratively to solve and find a solution. These tasks make the students gain valuable skills like communication skills, presentation skills, technical skills, and collaborative skills as they work together to solve real-world problems (Semerci et al., 2015). In cooperative learning, constructivist teachers assign activities to students that make them interdependent (Topping, 2005). Whereas all constructivist activities make use of collaborative learning, cooperative learning activities make students in a group depend on the knowledge of others for the completion of the task and to increase their understanding (Topping, 2005). In reciprocal learning, students take turns teaching one another as they work together, taking roles. One of the students takes the role of the 'doer' or tutor while the other is the 'observer' or tutee (Iserbyt, 2012). The doer teaches and explains the concept to the others while the observer is observing, analysing and giving feedback based on what the doer is doing (Merve, 2019). Figure 2.3 shows the difference between a traditional classroom and a constructivist classroom and the characteristics of both.

<b>Traditional Classroom</b>	<b>Constructivist Classroom</b>
Curriculum begins with the parts of the whole. Emphasizes basic skills.	Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts.
Strict adherence to fixed curriculum is highly valued.	Pursuit of student questions and interests is valued.
Materials are primarily textbooks and workbooks.	Materials include primary sources of material and manipulative materials.
Learning is based on repetition.	Learning is interactive, building on what the student already knows.
Teachers disseminate information to students; students are recipients of knowledge.	Teachers have a dialogue with students, helping students construct their own knowledge.
Teacher's role is directive, rooted in authority.	Teacher's role is interactive, rooted in negotiation.
Assessment is through testing, correct answers.	Assessment includes student works, observations, and points of view, as well as tests. Process is as important as product.
Knowledge is seen as inert.	Knowledge is seen as dynamic, ever changing with our experiences.
Students work primarily alone.	Students work primarily in groups.

*Figure 2.3 Differences between traditional classroom and constructivist classroom (University at Buffalo, 2019).*

#### **2.2.4 Humanism**

Humanism as a learning theory is a learning approach that focuses on human beings rather than ‘supernatural or divine insight’ (Al-Shammari et al., 2019). The humanistic learning theory believes that students must be at the centre of the teaching and learning process and so engages social skills, feelings, intellect and emotions as part of the teaching. At the core, humanist educators emphasize the freedom and autonomy of learners (Gandhi & Mukherji, 2022). This learning theory stems from Abraham Maslow’s theory of self-actualization (Maslow, 2013),

suggesting that the ability to learn depends on the fulfilment of other social needs and if those needs are not met, learning becomes difficult (Virtanen, 2022). At the core of the humanism learning theory is positive emotions. Humanists believe that students are driven by feelings and emotions more than rewards and punishments. They further postulate that if students are sad, distressed or upset about something, they are less likely to learn. Therefore, humanist teachers must create an enabling and safe classroom environment that helps the students to feel safe, as this will help them to focus on their learning (Muhajirah, 2020). Furthermore, feelings and knowledge are very important for humanists. They believe that lessons and activities must focus on both the intellect and the feelings of the students and not one or the other (Muhajirah, 2020).

According to Hare (2019), humanistic learning theory postulates that learners can be trusted to discover their own goals and so should be given some options and choices in what and how they learn at school. They can choose to read, listen to podcasts, watch movies or learn through social interactions. Also, students should be allowed to set their standards and evaluate their work themselves (Hare, 2019). Students are also allowed to establish how much they need to learn about a particular subject. Humanistic teachers believe that students must find an internal motivation to learn and this will most likely happen when students choose what, how and quantity of their learning interest. This emphasises the fact that in humanism, students are the authority of their learning (Javadi & Tahmasbi, 2020).

According to Virtanen (2022), self-evaluation is a very effective way to evaluate how learners are doing and learning. For humanists, grades are not as important as the learning goal and since students are allowed to choose their learning goal and content, the best way of assessment is self-evaluation. Researchers of the humanism theory have found that using grades with students encourages them to work for the grades rather than seek to learn, based on their interests or satisfaction (Javadi et al., 2020). Likewise, routine testing and rote learning won't lead to meaningful learning. Therefore, humanist teachers must facilitate and help students perform self-evaluations so the students can see how much progress they have made and so the teachers can know how students feel about their learning progress.

Summarily, in behaviourism, students experience a behaviour change that comes from the interaction between teacher stimuli and response. In cognitivism, students are taught to think about and reflect on how they learn, understand and take in new information. Students in constructivism classes participate in the construction of learning by fitting new information into pre-existing knowledge. Finally, in humanism, students are driven by feelings and emotions and so learn better when these are taken into consideration. Figure 2.4 shows a summary of the four major learning theories discussed in this section.

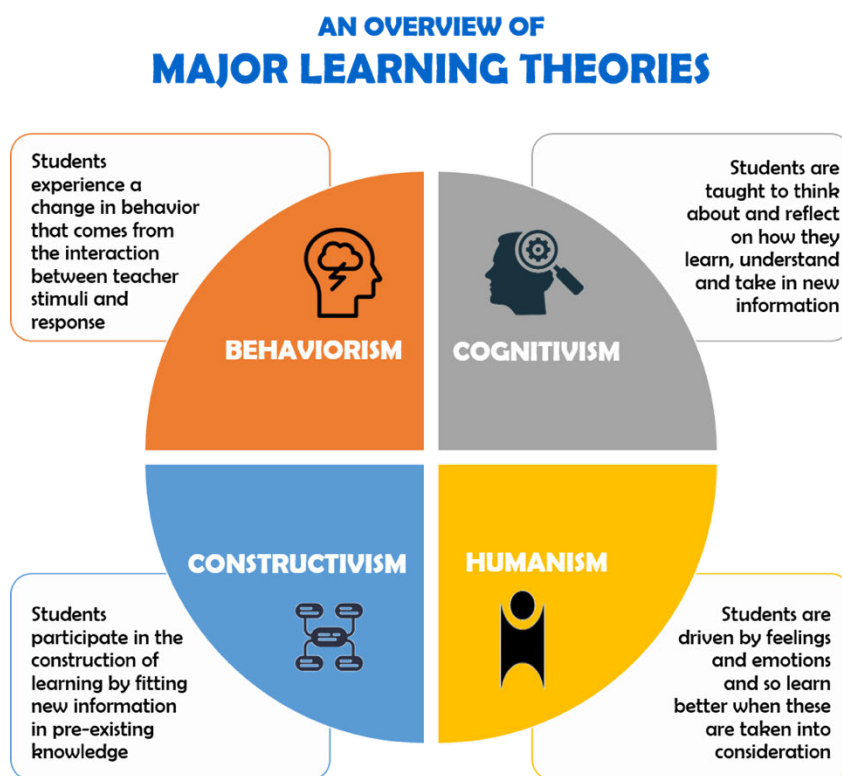


Figure 2.4 An overview of the major learning theories

### 2.3 Passive Uses of Technology in Education

Technology has revolutionized our world and indeed our day-to-day living (Roberts, 2019). The education sector hasn't been left behind as technology is offering new and innovative ways to teach and learn (Egielewa et al., 2022). While the main theories of learning discussed in the previous section above are great and may still be relevant to this day, it does not take into

consideration this technology age and does not teach educators how to integrate technology into their teaching and learning (Blewett, 2016b). However, in recent research, studies have been carried out on the use of technology for teaching and learning. One such way is through the passive use of technology, where students consume educational content with technology without actively engaging or interacting with it (Blewett, 2016b). This type of technology use in education involves having teachers teach by giving PowerPoint presentations, using videos and podcasts in the classroom, reading e-books on devices, and having online lectures (Okeji & Alex-Nmecha, 2021) which allow students to acquire knowledge and information at their own pace and convenience. Passive technology use in education has become increasingly popular due to its flexibility, accessibility, and affordability. However, it has also raised questions about its effectiveness in promoting deeper learning and critical thinking (Blewett, 2016b). This section will consider a few examples of how technology can be used in education passively. We will review relevant literature, discuss its benefits and see their limitations to effective learning.

### ***2.3.1 Death by PowerPoint***

Microsoft PowerPoint is a software application designed and released by Microsoft in 1990 (Duffy & Henry, 2016) as part of the Microsoft Office tools, designed specifically for making presentations interesting and increasing engagement. This was originally used by several business people to create outstanding slideshow presentations but has been adopted by several others including teachers. The use of PowerPoint has now become ubiquitous in education and many teachers are beginning to make use of technology in this way (Harden, 2008). Despite the many great design features of the software tool, several people, including teachers have simply used PowerPoint in a way that is uninteresting to their audience, in this case, students. In a research carried out by Draper, Cargill and Cutts (2002), students complain that they feel sleepy in class despite the use of PowerPoint. Some other students complain about how hard they find reading and writing long paragraph notes from slides, because of the choice of colour, font, size and length (Davis, 1993). Furthermore, while these may be manageable in the corporate office where immediate assessment isn't required and carried out, it becomes a great

challenge for most students when their understanding of class concepts and academic performance depends on these poorly presented lectures.

An overview of these shows that for most teachers according to Winn (2003), “PowerPoint is no more than a very convenient way to temporarily publish embellished teaching notes”. These boring, text-heavy, slide-intensive lectures are what are many times referred to as “Death by PowerPoint”. This term, coined first by Garber (2001), especially in education occurs when a teacher uses too many slides, includes too much text or data, uses small or unreadable fonts or colours or delivers a monotonous presentation. This usually results in the students becoming disengaged, losing interest and potentially missing important aspects of the lecture (Koppi & Pearson, 2003).

While the use of PowerPoint presentations in the classroom is a simple and convenient use of technology in education, it is a passive one (Draper et al., 2002). This becomes especially true when the class constantly results in ‘death by PowerPoint’. Despite the use of technology, students are generally bored, uninterested and passive due to the way teachers use the tool. While PowerPoint as a technology tool cannot be banned in the classroom, teachers must approach its use in such a way as to make it an engaging experience for students. According to Garber (2001), a simple six-by-six rule can be applied at the lowest level to prevent ‘death by PowerPoint’ and increase student engagement. This rule states that there should be no more than six lines of text on each slide and no more than six words in each line. This is corroborated by Winn (2003) who noted that students generally cannot write text and simultaneously absorb content from the teacher. He further noted that if a text-heavy slide is unavoidable, then the students should be given some time to copy the text while the teacher remains silent and thereafter, continues speaking.

Another way to maximize the use of PowerPoint for teaching without falling into the ‘death by PowerPoint’ problem is to allow the slides to facilitate the discussion. Linder in Garber (2001) said that “You are the star, not your slides”. Students want to connect with teachers and not the slides and so the slides should only guide and highlight the major teaching points and not be the teaching point themselves. As reiterated by Abernethy (2012), teachers must learn to focus on the students and be able to teach the entire class without the slides and not focus on the

slides. Maintaining eye contact with students helps increase engagement in the classroom. Winn (2003) also suggested the use of images rather than using text only while preparing the slides. A popular quote whose original author is unknown says “A picture is worth a thousand words” and the internet age makes this easy to apply when using PowerPoint to teach. There is almost no image or picture that cannot be gotten with the proper search engine and keywords (Winn, 2003), which can replace several texts on the slides and further drive the discussion in the right direction (Harden, 2008). To further increase engagement in the classroom, Duffy et al. (2016) suggested a few other alternatives to PowerPoint that can help change the game and make teaching interesting. These tools include Coggle, Freemind, Google Slides, Powtoon, Prezi, Keynote etc. These tools not only are visually appealing but also include animated presentations.

### ***2.3.2 Binge-Watching Videos***

Another way to use technology in the classroom is the introduction of videos; whether it is teacher-created videos, lecture slide videos or animated videos, videos are becoming a part of our teaching and learning (Woolfitt, 2015). Research has shown that videos have a significant positive effect on the training and development of students and teachers (Masats & Dooly, 2011). Videos which afford varied advantages for teaching and learning can provide useful material for students to engage with and learn from. One of the main benefits of using videos in education is that students are able to learn at their own pace. According to Mitra, Lewin-Jones, Barrett and Williamson (2010), students can pause, rewind, play and work through a video material as many times as possible until the concept is properly grasped. One student reported how he loved to learn with video because he learns more by seeing and listening which video provides (Özkan, 2002). Another benefit of using video in education is the constant access the students have to the video which can be watched anytime and anywhere. One student said, “I like videos because I can watch one or two lectures while I am waiting in a queue to do something” (Özkan, 2002). With video, students are not restricted to be in class before they can get content. The lecturers can pre-record the content or send the link to the video and the students can watch it at their convenience (Smith, Ruocco, & Jansen, 1999).

However, with the development of binge-watching, the use of videos in education is a passive use of technology. Binge-watching refers to the act of watching multiple episodes of a television show in one sitting, usually for long hours on end (Ahmed, 2017). This has become more popular with the rise of video streaming platforms like Netflix, and Hulu. The major characteristic of binge-watching is the fact that people have to sit passively for long hours consuming video content (Ahmed, 2017). Research has shown that binge-watching can lead to increased stress, anxiety, depression and a decrease in social interaction (Riddle, Peebles, Davis, Xu, & Schroeder, 2018). A critical look at how videos are being used in the classroom also poses similar problems for our students.

One such case is when students are required to watch long video content, and worse still is if the video has very little relevance to the class content. A student once complained that he did not like his teacher sending videos to the learning platform (Smith et al., 1999), because according to him “the video was usually longer than 1 hour”. Another study showed that 70% of Students will not watch a video that is longer than 20 mins, and the rest only watched it when it had a direct impact on their grading or performance (Woolfitt, 2015). This reveals that the concept of binge-watching does not apply to educational videos. Students do not appreciate sitting for long hours watching a long video of content that must be memorised or learnt. Additionally, the type of video also determines how effective it will be for teaching and learning. Gavin (2022) suggested that while videos are effective in the classroom, animated, story-like videos or relevant real-life videos are more effective than videos that show the lecturer talking through PowerPoint slides. Using videos in the latter way, although involves the use of technology is a passive use and would not engage the students in the classroom or outside of it.

According to Gavin (2022), he recommended that if videos would be used in the classroom, they must be short and relevant to the concept being taught. Furthermore, the videos must not be a replacement for the lecturer in class (Mitra et al., 2010), with a teacher simply explaining through PowerPoint slides or talking to a whiteboard, but fun, engaging videos created or found on the internet can be used. Additionally, other tips can be used to make the use of video effective and engaging for students. According to Kung (2019), lecturers mentioned that they

would rather load the video into software like PlayPosit which allows for video monitoring and assessment. Assessment questions and prompts can be added to the video at intermittent points. Students are then forced to pause the video, think about the concept and answer the question posed. Mitra et al. (2010) also mentioned that he would play the short video in class and pause at intervals to explain the video to the students and then have the students discuss and summarise the video either individually or in groups. This further engages the students and makes them active; thereby making the use of videos interactive and engaging.

### ***2.3.3 E-Books in Tablets***

The rise of education technology has made several EdTech businesses design and build several tablets. According to them, their tablets will help schools use technology to teach and help students learn with technology. In most cases, these tablets are preloaded with e-books, videos, PowerPoint slides and in some cases, the ability to perform online live lectures. Unfortunately, Sancho-Gil, Rivera-Vargas and Miño-Puigcercós (2020) report how the tablet project failed in its implementation due to several reasons. Another report in a study by Viriyapong and Harfield (2013) also discusses the failure of tablet integration into the classroom. According to them, students were rather becoming more disengaged than engaged in the classroom.

One of the biggest disadvantages of its use in the classroom is the distraction which it brings to students (Viriyapong et al., 2013). Rather than students concentrating on the material and topic, several of them become distracted by games, surfing the internet and social media. According to an Education Business (2014) study, students performed better when studying without the tablet than with the tablet because according to the report, they became often distracted by the device. Additionally, technology devices are prone to technical failures and this is another disadvantage of using the tablets. Sancho-Gil et al. (2020) reported that students who were less technical found learning with tablets a frustration rather than a help. They complain about the struggle to keep the device battery properly charged, the lack of technical know-how to navigate the tablet and get work done with it, and the software or hardware problems that tablets have (Lai, 2012). One student complained bitterly about how she almost

failed a test because of connectivity issues which took more than half of the time allocated for the online assessment (Viriyapong et al., 2013).

Furthermore, most e-books are simply pdf formatted text materials copied and uploaded onto these tablets. Students find reading on tablets boring (Lai, 2012) and sometimes difficult. One student reported that he constantly has aches in his eyes and head whenever he reads for long hours on the tablet (Liu, 2022) and so no matter how much he loves to read, he cannot do so for long. In another case, the report showed that while more students prefer the ease and comfortability of carrying all books as e-books on a single tablet, 65% of students would still rather prefer to read a physical textbook than an e-book on a tablet (Svela, Nouri, Viberg, & Zhang, 2019). While explaining the reason, one student mentioned that he would always doze off while reading on a device and so would prefer a physical textbook (Svela et al., 2019). Another student complained about how boring it was because he can't highlight, underline or interact with the digital book on the tablet (Liu, 2022). These reports show that even though using tablets can be an easy and convenient use of technology, it is a passive way to use technology in the classroom.

However, Lai (2012) recommended that if tablets must be used for teaching and learning, both the teachers and the students must be trained to teach with it and learn with it respectively. A technical team or department must be set up to provide constant technical support for both teachers and students who might need it (Lai, 2012). Additionally, if e-books must be used on tablets, these books must be created interactively, with visual elements and links that can be clicked and explored (Education Business, 2014). One advantage of the e-book over a physical one is the fact that students can engage with content and expand their learning beyond the book (Clarke & Svanaes, 2014) with the use of the internet. This will make studying engaging and fun for students.

#### ***2.3.4 Synchronous Live Online Lectures***

COVID-19 has had a great impact on our world and especially on the education system (Daniel, 2020). One such impact is the introduction of live online lectures to the school system. While the ability to hold live online meetings is not new with tools like Skype, Google Meet, and

Zoom (amongst others) being in existence long before now, their use in the education system is fairly new. According to Daniel (2020), due to its sudden outburst in the global world, teachers were forced to transition to teaching online using these tools with little or no training on how to best use them for effectiveness. In a study by Huang (2020), teachers said they did not know what to do, they just got in and started talking. In most cases, teachers complained that it was difficult teaching on a screen where they were not seeing the students and their reactions as they taught (Zheng, Wisniewski, Rosson, & Carroll, 2016). Furthermore, teachers need to be trained to perform simple tasks like mute and unmute, show or close video, and screen share all of which will impact the success or otherwise of the online class. This is buttressed by a trending video that reported how a lecturer taught on Zoom for over 2 hours and had his device muted the whole time and the students heard nothing the entire time (Koay, 2021). This meant that he never asked for feedback from his students, he never attempted to interact with his students the entire time, and he just kept talking. Unfortunately, students have also been forced to sit through boring lectures online, with teachers who simply translate what they do physically to the online platform (Hew, Jia, Gonda, & Bai, 2020). While the use of this live lecture technology software has changed the education game by removing the limits of a physical classroom, if not properly done, it will only result in a passive use of technology in the classroom (Wingo, Peters, Ivankova, & Gurley, 2016).

Daniel (2020) suggested that teachers and students be trained regularly on these different live lecture tools and how they can be used effectively for teaching and learning. In addition to the training of the users, teachers who teach live online must from time to time (no longer than 10 minutes intervals), seek student input and interaction to allow for their engagement. One teacher would regularly at intervals ask his students to send their thoughts or answer a particular question on the chat (Hew et al., 2020). Another teacher would regularly call on random students, ask them to show their videos, unmute themselves and answer a particular question. Another tip would be to ask all students to leave their videos on the entire time so they all can maintain 'eye contact' while the class lasts. According to Singh, Mangalaraj and Taneja (2010), in an online environment, teachers can extend the class and engage the students by using other online tools while teaching. Tools like Plickers, Kahoot, Quizziz, Poll Everything and other online presentation tools can help increase student engagement while teaching online. Once

students know that the lecture will be interactive and that they will be required to answer questions throughout the online session, they will be focused and engaged and they will eventually learn.

## 2.4 Pedagogy of Learning

The pedagogy of learning plays a crucial role in shaping educational practices and determining the effectiveness of teaching methodologies. With the integration of technology in education, educators have explored various pedagogical approaches to enhance student learning outcomes. One such approach is the active pedagogic approach, which emphasizes student engagement, critical thinking, and collaborative learning.

According to CEI (2015), pedagogy is the art and science of teaching. It is a broad term that describes the process of designing, delivering, and assessing learning experiences and encompasses a variety of teaching methods, learning activities, and assessment tools (Clark, 2014). Teaching methods are the strategies that instructors use to deliver content to students. Some common teaching methods include lectures, discussions, group work, and hands-on activities, role play (D'Silva, 2010). Furthermore, learning activities are the tasks that students must complete to learn the content being presented to them. These activities can be individual or group projects, homework assignments, hands-on tasks, gamified activities or assessments. Learning assessments are the tools that teachers use to measure student learning. Learning assessments can be quizzes, tests, projects, or portfolios (Laurillard, 2007).

Pedagogy is a complex and ever-evolving field. There is no single "right" way to teach, and the best pedagogy for a particular group of students will vary depending on their needs, interests, learning styles and also the topic to be taught. However, it is important to get a suitable pedagogy that will help the students learn appropriately.

Traditional instructional methods often adopt a passive pedagogical approach, where students assume a more passive role in the learning process. In such settings, students are primarily recipients of information rather than active participants in knowledge construction. Research studies have indicated that this approach may not be optimal for promoting deep learning and

long-term retention of information (Serbessa, 2006). Passive pedagogy relies heavily on teacher-centred instruction, where the instructor serves as the primary source of knowledge dissemination, and students are expected to absorb and reproduce the information provided.

### 2.4.1 Pedagogic learning shifts

For learning to take place, a set of transformational pedagogic learning shifts needed to take place in order to respond to how students learn in the 21st-century learning environment (Chigona, 2015). A good understanding of these shifts helps teachers to know how to teach effectively with technology such that students can learn appropriately and be engaged in it. There are four major pedagogical shifts as shown in figure 2.5 that must be considered.

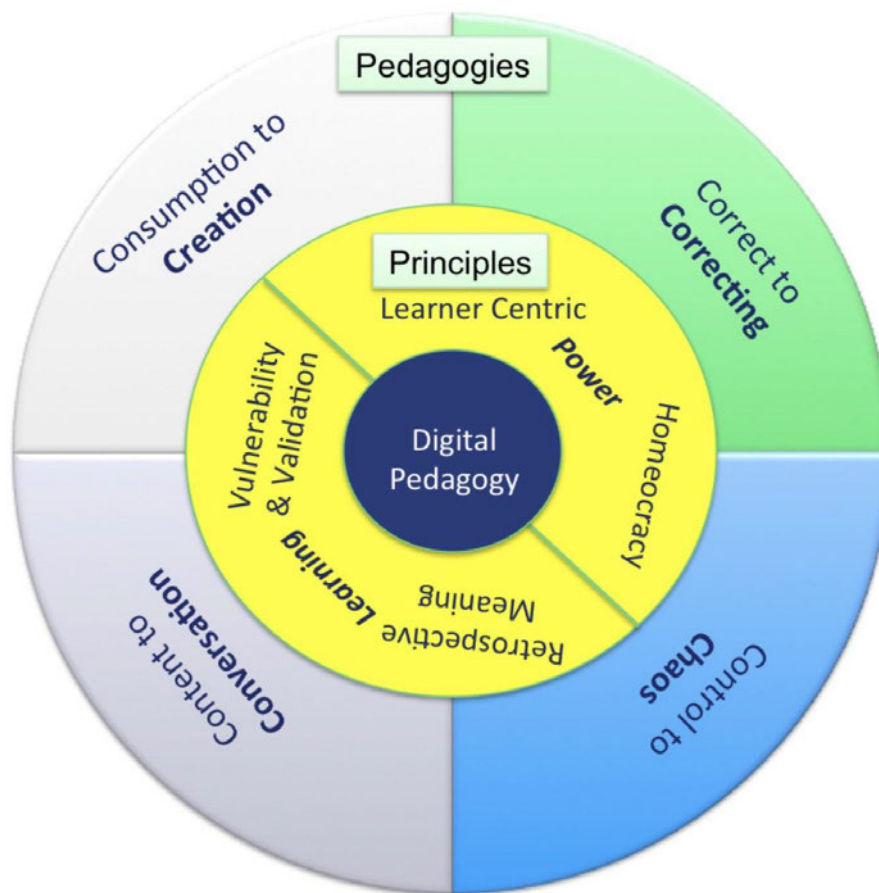


Figure 2.5 Major pedagogical shifts for effective teaching and learning (Blewett, 2016a)

The first shift is the move from consumption to creation. The traditional learning approach focuses more on the consumption of content. The teacher teaches with the assumption that the students have nothing to contribute and that they must simply consume the content given to them by the teacher. So even though technology is used, teachers still emphasise the consumption of the content given to the students (Godwin-Jones, 2015). So whether it is a PowerPoint presentation, e-books on tablets, or the use of videos in the classroom, the traditional approach to teaching places emphasis on consuming content rather than allowing the students to create the content. However, as noted by Blewett (2016a) digital environments open up several opportunities to not only consume but also create content. Both teachers and students can maximise the opportunities and affordances of technology to teach and learn through content creation. With video creation tools, wikis, simple graphic tools etc. students can learn while creating content.

The second pedagogical shift is the move from correct to correcting. One of the major challenges of the traditional methods of teaching is the focus on content being correct (Blewett, 2016a) rather than constantly correcting. This has made students focus on whatever it takes for them to get the ‘correct answer’, rather than being free to explore the content and not mind if they fail (Alfi, Assor, & Katz\*, 2004), and hence learning in the process. In contrast, however, teaching with technology makes it possible to help students focus on the learning process while constantly improving content. Digital technologies like Wikis and Collaborative document tools like Google Docs, allow for continuous content improvement. This encourages students to shift their focus from cramming to learning (McIntyre & Munson, 2008).

The third pedagogical shift is a move from content-based classrooms to conversation-based classrooms. As succinctly put by Blewett (2016a), traditional learning approaches focus on the “reading, remembering and reproducing of content while conversation-based approaches focus on learning through discourse”. In a traditional teaching environment, students are not encouraged to talk or hold conversations based on the content. In research by Sfard, Neshet, Streefland, Cobb and Mason (1998), the power of conversation was explored in the learning of Mathematics. This is what makes social media-like technology tools powerful, engaging and effective as a learning tool. Students who are used to holding conversations around a topic on

social media through comments, shares and likes, can transfer that as they hold conversations around class content.

The fourth and final shift in pedagogy is from control to chaos. Traditional approaches to learning focus on the teacher as he firmly holds control of the class. The choices of content, methodology, and how the content would be engaged are all determined by the teacher and not the students (Blewett, 2016a). In this kind of classroom, the students are presented with a set of facts and are controlled on how they must answer them. Conversely, technology-enabled classrooms with digital pedagogies are built around some form of ‘noise’ and chaos (Antunes, Armellini, & Howe, 2023), allowing students to make meaning out of the cacophony and ubiquitous nature of available content. Technology tools like mind mapping tools, curation and creation tools encourage students to see patterns and find meaning in a noisy content.

These pedagogical shifts from consumption to creation, correct to correcting, content to conversation, and control to chaos are all important in understanding how students can learn in a digitally supported environment. Students must be trained and allowed to maximize the affordances of technology in such a way that they are engaged and learn effectively.

#### ***2.4.2 Active pedagogic approach***

The active pedagogic approach encourages students to become active participants in the learning process, fostering a deeper understanding of the subject matter. Active pedagogy encompasses a range of instructional strategies, including problem-solving activities, group discussions, project-based learning, and hands-on experiences (Paulson & Faust, 2000). This approach shifts the focus from the teacher as the sole provider of knowledge to a learner-centred environment where students engage in critical thinking, reflection, and knowledge construction.

Numerous studies have investigated the benefits of active pedagogical approaches in enhancing student learning outcomes. For instance, Masek et al. (2012) conducted a meta-analysis of studies comparing student performance in traditional lecture-based classes versus classes that incorporated interactive engagement techniques. The findings revealed that students in interactive engagement classes consistently outperformed their counterparts in conceptual

understanding and problem-solving abilities. Similarly, Freeman et al. (2014) analysed active learning strategies in undergraduate STEM courses and found that active pedagogical approaches significantly improved student exam performance and reduced failure rates.

Furthermore, when active pedagogy is combined with the integration of technology in the classroom, it has the potential to amplify its impact on student learning. The use of educational technologies, such as online simulations, multimedia resources, and collaborative platforms, can provide students with opportunities for self-directed exploration, problem-solving, and information retrieval (Klimova & Kacetl, 2015). By leveraging technology as a tool for active learning, educators can create interactive and engaging learning environments that foster critical thinking, creativity, and collaboration among students.

Summarily, the adoption of an active pedagogic approach to teaching with technology holds promise for improving student learning outcomes. By empowering students to take an active role in their education, this approach nurtures their ability to think critically, work collaboratively, and apply knowledge in real-world contexts. The subsequent sections of this literature review will delve deeper into specific studies and findings that shed light on the active learning approaches and the impact technology has on them.

## **2.5 Active Learning Approaches**

Several pieces of research have been carried out in the pre-digital years to identify different active learning approaches that can increase student engagement in the classroom. As defined by Carr, Palmer and Hagel (2015), active learning refers to the efforts of students to actively construct their knowledge. Active learning is those activities that students do to construct knowledge and understanding, which requires higher-order thinking (Brame, 2016). This is largely associated with the constructivist learning approach where students learn by constructing new knowledge, rather than passively taking in content (Dennick, 2016). Active learning methods help students participate in the class rather than sitting still, memorizing content and regurgitating back to the teacher (Brame, 2016). Active learning is a way of learning that engages students in the learning process and encourages them to reflect on their learning instead of imbibing the content (Blewett, 2016a).

One of the earliest research projects carried out on active learning is the one by Stanford researchers Thompson, Califf and Mooney (1999). Active learning methods were used in research on natural language acquisition. Active learning was applied to information extraction and semantic parsing and this reduced effort made by teachers to annotate and yet still maintain a high level of productivity (Thompson et al., 1999). As identified by the researchers, active learning transfers the responsibility to learn from the teacher to the learner and engages the learners.

Strategies like small group discussions, debate, peer instruction exercises and case-based problem-solving exercises are all strategies suggested by VPTL-Staff (2000) that can increase classroom participation and thereby increase student engagement. Paulson et al. (2000) also discuss several active learning strategies that can be used by college students. Examples of such strategies are “The one-minute paper” and “the clarification pauses”. According to Paulson et al. (2000), these strategies help students to relate what they’re learning in the classroom to real-life experiences. It engages the students and increases their academic performance at the end of the semester.

According to Armbruster, Patel, Johnson and Weiss (2009), active learning ensures students engage in instructional activities that help them do things and think about what they do. This means that active learning encourages students to do and not just read and listen in class. It also improves higher-order thinking skills in the students (Brame, 2017). Active learning strategies help students engage in other activities beyond taking notes and following directions. Students can engage in activities that build new knowledge and scientific skills (Freeman et al., 2014).

In recent years, a lot of researchers have begun to research active ways of teaching and learning. According to Pierce and Fox (2012), teaching and learning have been boring and passive and students find it difficult to understand the content being presented. Traditional teaching approaches have been referred to as the “talk & chalk” way (Becker & Watts, 2001) and these approaches have left students disengaged in the learning process. According to Pierce et al. (2012), these kinds of teaching approaches should not be used in the 21st-century class.

Brame (2016) discusses several active learning approaches that can be used by teachers in place of the conventional lecture method. The strip sequence technique is one where the teacher gives

the students several strips of the different steps involved in a process all jumbled together. The students are therefore tasked to work together to reconstruct the proper sequence. This helps strengthen the logical thinking of the students and tests the mental model of a process (Handelsman, Miller, & Pfund, 2007). Another active learning technique is what he referred to as the “student-generated test questions”. Here, the teacher provides the students with the learning goals, with relevant action verbs for a particular topic. He then asks the students to generate test questions using the provided action verbs. This approach helps the students to think about what they know and also consider the implications of the teacher’s goals (Brame, 2016). Case-based learning is also a learning approach where the students are presented with real cases that are adapted from the larger world and which require the students to think through the situation and reach a conclusion. This approach sees students applying their knowledge to real-world problems and thinking about the implications (Brame, 2016).

There are four major categories of Active learning approaches as discovered by Ruiz-Primo, Briggs, Iverson, Talbot and Shepard (2011). In their research, they found that active learning activities can be concept-oriented tasks, collaborative learning activities, technology-enabled activities and inquiry-based projects and some active learning approaches can be a combination of these four categories (Ruiz-Primo et al., 2011). Several researchers have examined the different active learning approaches and their impact on overall student outcomes and academic performance (Brame, 2017). These researches have considered collaborative learning, inquiry-based learning and concept-oriented tasks and examples are discussed below.

In research carried out by Paulson et al. (2000), they discuss several active learning strategies that can be used in a college classroom. These strategies range from activities for individual students to activities for question & answer. There are also active learning activities that help the teacher gain immediate feedback from the learners. One interesting category of active learning strategies discussed by Paulson et al. (2000) is cooperative learning or collaborative learning. Students are placed in either spontaneously formed groups or pre-planned heterogeneous groups for critical thinking, brainstorming and peer-tutoring. Learners take up the responsibility of solving whatever problem is assigned to the group which keeps them engaged and active in their learning process (Paulson et al., 2000).

As seen in the research reviewed above, most of the active learning approaches do not consider technology. Whereas as researched by Ruiz-Primo et al. (2011), there are four major categories of active learning approaches, namely collaborative learning, concept-oriented, inquiry-based learning and technology-enabled activities; there is very little research found that is technology-enabled. Most active learning activities make learners active but do not make use of technology, which today's learners are natural users of (Blewett, 2016b).

## **2.6 Technology-enabled Active Learning Approaches**

In most of the approaches considered above, there was very little reference to the use of technology. Several of these active learning approaches did not put into consideration the application of technology. Certain researchers who mention the use of technology in creating engagement in the classroom like Misseyanni, Lytras, Papadopoulou and Marouli (2018) linked active learning strategies to creative and innovative ideas that can be used in the classroom. Clark (2014) in his research in a secondary mathematics classroom, made use of flipped classroom learning. In the flipped classroom model, students are required to watch video lessons at home and then discussions and activities take place in class (Clark, 2014). This involves the use of technology to view the videos at home before students can participate in in-class discussions and tasks. Clark (2014) tested the impact on student engagement and academic performance.

In research carried out on 811 undergraduate students at the Massachusetts Institute of Technology (MIT), technology-enabled active learning strategies were used to teach the various concepts of electromagnetism. Dori and Belcher (2005) used education technology to present “spatial and dynamic images” that showed the complex relationships between the various electromagnetic concepts. The research consisted of several experimental groups and a control group. The results showed that the students in the experimental groups that learnt via the technology-enabled active learning approaches showed a significantly higher conceptual understanding of the concepts than their control group peers (Dori et al., 2005). Those students specified that the benefits of interactivity visualization and hands-on experiment that was made possible by technology brought about a higher level of understanding.

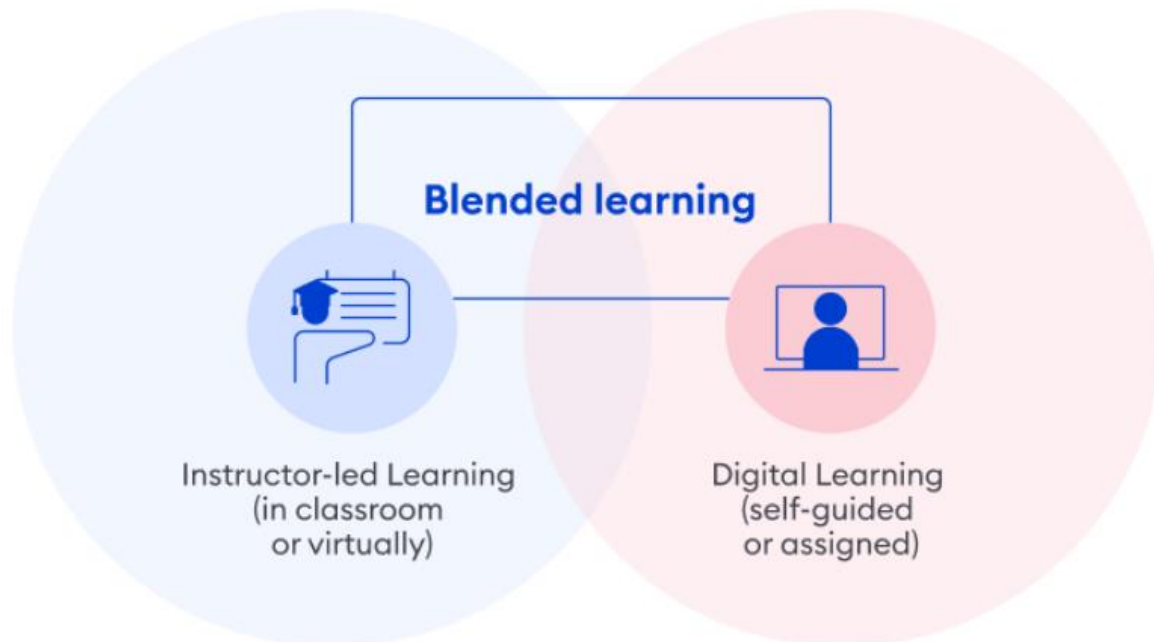
In another study at the Universiti Tun Hussein Onn, Malaysia, students were taught using technology-enabled active learning approaches. Results in the Hassan, Puteh and Buhari (2015) research showed that there is a relationship between the level of application of technology-enabled active learning methods and the understanding of students in enhancing their creativity and innovations. They also discovered that to enhance the creativity and innovations of the students, both the instructors and the students must together apply technology-enabled active learning strategies to their teaching and learning (Hassan et al., 2015).

Technology tools, devices and software have also been used to increase engagement among students in and out of the classroom. With appropriate training of both the teachers and students (Armstrong, 2011), kindles, tablets and iPads have become great tools for teaching and learning purposes. Several education apps can be installed on these devices that help students think, interact and learn. Plump and LaRosa (2017) made all students install Kahoot and used it for daily formative assessments. The gamified way that Kahoot works, makes the students excited and always eager to learn with it. Additionally, when used properly, videos and digital content can be used to engage students in and outside the classroom. It can be used for blended learning, hybrid learning or a flipped classroom. All these describe the use of digital materials like online activities, videos, and e-books together with a face-to-face component (Wang & Lieberoth, 2016). The sections below will explore specific studies that have investigated these technology-enabled active learning approaches and their impact on student learning outcomes, shedding further light on their effectiveness in various educational contexts.

### ***2.6.1 Blended Learning***

Blended learning, characterized by the integration of face-to-face instruction with online components, has emerged as a pedagogical approach that seeks to enhance student learning experiences (Poon, 2013). Unlike fully online or face-to-face classroom-based instruction, blended learning combines the strengths of both modalities to create a synergistic learning environment. In this approach, students engage in a combination of in-person activities and online tasks facilitated through a learning management system (LMS) (Allan, 2007). The

online component is designed to complement and extend the face-to-face interactions, rather than replace them. Figure 2.6 shows an image of the blended learning active approach.



*Figure 2.6 An image showing the blended learning active approach (Kolinski, 2022)*

The integration of online components in blended learning provides students with opportunities for self-paced learning and access to a variety of resources to deepen their understanding of the subject matter (Poon, 2013). For instance, students may be assigned tasks such as listening to podcasts or reading articles online related to the topics discussed in the classroom. These additional resources serve to reinforce the concepts covered during face-to-face sessions and provide students with alternative perspectives and supplementary materials (Ginns & Ellis, 2007). By engaging with online materials, students can delve deeper into the subject matter, explore different viewpoints, and reinforce their learning.

Blended learning approaches have demonstrated positive impacts on student engagement and understanding. A study by Ginns et al. (2007) examined the effects of online resources in a blended learning environment and found that students who actively engaged with the online materials exhibited higher levels of understanding compared to those who solely relied on

traditional classroom instruction. The flexibility offered by the online component allows students to revisit and review the content at their own pace, catering to individual learning preferences and providing opportunities for personalized learning (Bazelais et al., 2018).

Furthermore, blended learning can promote active learning strategies by incorporating interactive online activities. For example, students may be assigned online discussions, collaborative projects, or interactive simulations that foster active participation and knowledge construction (Megahed et al., 2022). These interactive elements encourage critical thinking, problem-solving, and collaborative skills development, thereby enhancing the overall learning experience.

Summarily, blended learning, with its combination of face-to-face and online components, offers a promising approach to improving student engagement and understanding. By leveraging the benefits of both modalities, students can access a wealth of resources, engage in self-paced learning, and participate in interactive online activities.

### ***2.6.2 Hybrid Learning***

Hybrid learning, akin to blended learning, encompasses a pedagogical approach where students engage in activities both in a face-to-face setting and online. Whereas in a blended learning environment, the online component serves to compliment and not replace the face-to-face components; in hybrid learning, the online component serves to partially "replace" certain aspects of the face-to-face component (Mazaudier, 2021). This flexibility allows instructors to adapt their teaching methods to optimize the learning experience. In a hybrid learning environment, lectures can be moved online in a synchronous mode, while in-class activities continue. Conversely, as observed in a study by Bülow (2022), students may watch a video during class time and subsequently participate in an asynchronous online discussion using a conversation tool. Importantly, in hybrid learning, students are expected to actively participate in all components of the learning process, regardless of whether it occurs online or face-to-face.

Hybrid learning offers both synchronous and asynchronous modalities. Synchronous activities involve real-time engagement where students and instructors come together simultaneously.

This includes live lectures, scheduled discussions, and activities that require all participants to be present at specific times (Klimova et al., 2015). Synchronous interactions allow for immediate feedback, dynamic discussions, and collaborative learning experiences. Conversely, asynchronous activities take place over a period of time, allowing students to engage with course content and complete tasks at their own pace. Examples of asynchronous activities include discussion forums, independent study, and self-paced assignments. These activities provide students with the flexibility to manage their time effectively and engage with the material when it suits them best (Bülow, 2022).

Hybrid learning has shown promise in promoting active learning and student engagement. Research by Mazaudier (2021) demonstrated that incorporating online components in hybrid learning led to increased student participation, higher levels of engagement, and improved learning outcomes. The combination of face-to-face and online elements creates a learning environment that caters to diverse learning preferences and individual schedules. It provides opportunities for students to deepen their understanding through interactive online resources and to collaborate with peers through both synchronous and asynchronous discussions (Bülow, 2022).

By integrating synchronous and asynchronous activities, hybrid learning offers the advantages of real-time interactions and flexibility, catering to the needs of different learners. It encourages active participation, critical thinking, and independent learning.

### ***2.6.3 Flipped Classroom***

The flipped classroom model, a form of blended or hybrid learning, offers an active and learner-centred approach where students engage with both face-to-face and online components of instruction (Ekici, 2021). In a traditional classroom setting, students typically receive direct instruction from the teacher during class time, followed by independent practice outside of class. However, in a flipped classroom, the initial exposure to foundational concepts occurs outside of the classroom through various means such as readings, podcasts, or videos, while classroom time is devoted to discussions, interactions, and collaborative activities (Eppard & Rochdi, 2017). This inversion of the traditional model allows students to explore and absorb

content at their own pace while providing increased opportunities for active engagement during class, as shown in figure 2.7.

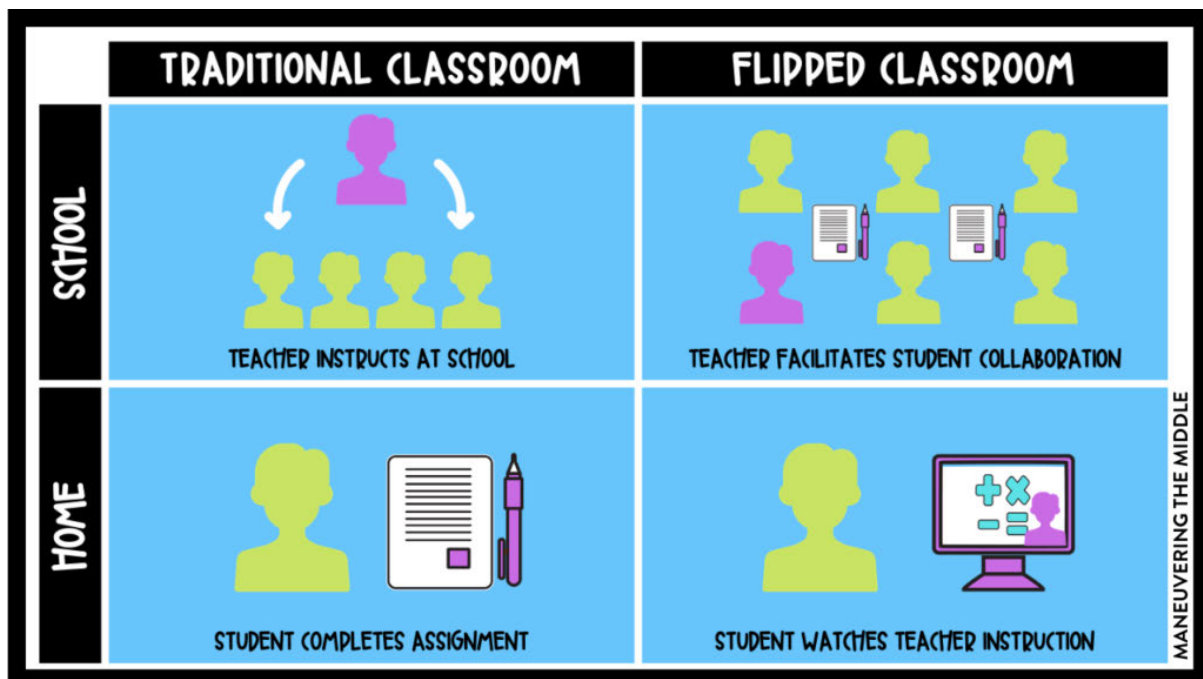


Figure 2.7 An overview of what a flipped classroom is (Brack, 2020)

The flipped classroom approach has been found to offer several advantages. Research suggests that this model promotes personalized learning, as students have the flexibility to access instructional materials in a format that suits their preferences and learning styles (Ekici, 2021). By engaging with online resources before coming to class, students can acquire the foundational knowledge necessary to actively participate in collaborative and problem-solving activities during face-to-face sessions. This model also allows for increased student-teacher and student-student interactions, as classroom time can be dedicated to addressing questions, engaging in discussions, and working on projects collectively (Denton, 2022).

Furthermore, the flipped classroom provides additional time for hands-on and application-based learning experiences, enabling students to deepen their understanding of concepts and develop higher-order thinking skills (Pande & Bharathi, 2020). By moving away from passive lecture-based instruction and embracing active learning strategies, students are encouraged to

analyse, synthesize, and apply knowledge in real-world contexts (Eppard et al., 2017). This approach fosters critical thinking, problem-solving abilities, and collaborative skills, all of which are essential for success in today's rapidly changing and interconnected world.

Studies have demonstrated the positive impact of the flipped classroom model on student learning outcomes. For instance, a study by Roehl, Reddy and Shannon (2013) found that students in a flipped classroom setting demonstrated significant improvements in content mastery, critical thinking, and problem-solving skills compared to those in a traditional classroom. Another study by Hew et al. (2020) reported that students in a flipped classroom environment displayed higher levels of engagement, satisfaction, and academic achievement compared to students in a traditional classroom setting.

In summary, the flipped classroom model, within the framework of blended or hybrid learning, offers an active and student-centred approach to education. By leveraging technology and providing pre-class content delivery, this approach empowers students to take control of their learning, engage in collaborative activities, and develop higher-order cognitive skills. The subsequent paragraphs of this literature review will delve into specific research studies that further explore the impact of the flipped classroom model on student learning outcomes in different educational contexts.

#### ***2.6.4 Gamification***

Gamification, a pedagogical approach that incorporates game elements and principles into the learning process, has gained considerable attention in educational research. By integrating features such as point systems, leaderboards, badges, and rewards, educators can create an interactive and immersive game-like environment to increase student motivation, engagement, and active participation (Apostol et al., 2013). Gamified learning experiences provide students with immediate feedback, clear goals, and meaningful challenges, fostering a sense of autonomy and mastery (Parra-González, López-Belmonte, Segura-Robles, & Moreno-Guerrero, 2021).

Studies have demonstrated the positive impact of gamification on student motivation. The introduction of game elements in the learning process can tap into intrinsic motivators, such as

a sense of achievement, competition, and progress, which can significantly enhance student engagement (Faiella et al., 2015). Students are more likely to be motivated to actively participate in learning activities when they are presented with goals and rewards that align with their interests and preferences (Parra-González et al., 2021). The use of gamification strategies can create a supportive and stimulating learning environment that encourages students to persevere, take risks, and explore new concepts and skills (Apostol et al., 2013).

Furthermore, gamification has been shown to positively influence learning outcomes. By providing students with immediate feedback on their progress and performance, gamified learning experiences enable learners to monitor their own learning and make necessary adjustments (Faiella et al., 2015). The clear goals and challenges presented in a gamified context help students focus their efforts, set targets, and strive for continuous improvement. This goal-oriented approach can lead to enhanced knowledge acquisition, skill development, and retention of information (Wang et al., 2016). Research has indicated that gamification can have a positive impact on student achievement and academic performance across various educational levels and subject domains (Kapp, 2012).

Additionally, gamification can contribute to the overall enjoyment of the learning process. By introducing elements of fun, excitement, and competition, gamified learning experiences create a more engaging and entertaining atmosphere (Apostol et al., 2013). This can foster a positive affective state, reducing anxiety and boredom commonly associated with traditional instructional methods (Wang et al., 2016). When students are immersed in a gamified environment that stimulates their curiosity, creativity, and problem-solving skills, they are more likely to develop a positive attitude towards learning and sustain their interest in the subject matter (Kapp, 2012).

In summary, gamification offers a promising approach to enhancing student motivation, engagement, and learning outcomes. By leveraging game elements and principles, educators can create dynamic and immersive learning experiences that tap into students' intrinsic motivators, provide clear goals and feedback, and foster a positive affective state.

### ***2.6.5 Web-based tools***

Web-based tools have become increasingly prevalent in educational settings, providing opportunities for technology-enabled active learning. These tools offer a range of functionalities that support collaborative learning, information sharing, and multimedia presentation creation (Naparín & Saad, 2017). By incorporating web-based tools into teaching and learning, educators can enhance student engagement and facilitate meaningful interactions in the digital learning environment (Armstrong, 2011).

One common use of web-based tools is for creating interactive presentations. Platforms such as Prezi, Google Slides, and Microsoft Sway enable students and teachers to design visually appealing and dynamic presentations that go beyond traditional slide decks (Strasser, 2014). These tools often offer features like embedded multimedia, hyperlinking, and interactive elements that encourage active exploration and participation. By utilizing these web-based presentation tools, educators can encourage students to construct knowledge actively, present information in engaging ways, and foster a deeper understanding of the content (Santiana & Fatimah, 2017).

Collaboration is another key aspect of active learning that can be facilitated through web-based tools. Online platforms like Google Docs, Microsoft Teams, and Slack provide spaces for real-time collaboration, document sharing, and discussion among students (Lomas, Burke, & Page, 2008). These tools allow students to work together on group projects, share ideas, and provide feedback to their peers, irrespective of geographical limitations. Collaborative web-based tools enhance student engagement and promote critical thinking, problem-solving, and communication skills (Berger, Mohr, Nösekabel, & Schäfer, 2003). They also foster a sense of collective ownership and responsibility within the learning community.

In addition to presentations and collaboration, web-based tools offer opportunities for information sharing and dissemination. As reported in research by Molina and Mateo-Guillén (2021), tools like Padlet, Flipgrid, and blogs enable students to share their ideas, reflections, and multimedia content with their peers and the wider audience. These platforms provide avenues for students to showcase their creativity, engage in discussions, and receive feedback from their peers or the online community (Mardi, Walsh-Rock, & Balcerzak, 2021). By

leveraging web-based tools for information sharing, students actively participate in knowledge creation, dissemination, and curation, thereby strengthening their digital literacy skills and fostering a sense of agency in their learning (Molina et al., 2021).

Research has shown that the integration of web-based tools in teaching and learning can have positive impacts on student engagement and academic performance. Studies have indicated that the use of web-based tools enhances student motivation, active participation, and critical thinking skills (Naparín et al., 2017). By leveraging the interactive and collaborative features of these tools, educators can create learner-centred environments that facilitate active engagement, foster peer interaction, and promote higher-order thinking (Berger et al., 2003). Furthermore, web-based tools enable teachers to provide timely feedback and support individualized instruction, thereby catering to diverse student needs and promoting better learning outcomes (Santiana et al., 2017).

Finally, web-based tools offer valuable opportunities for technology-enabled active learning in educational settings. By incorporating these tools into teaching and learning practices, educators can facilitate interactive presentations, foster collaboration, and promote information sharing among students. The integration of web-based tools enhances student engagement, critical thinking, and digital literacy skills, contributing to improved academic performance.

In conclusion, technology-enabled active learning approaches offer promising opportunities to enhance student engagement and academic performance in teaching and learning contexts. Through the exploration of blended learning, hybrid learning, flipped classrooms, gamification, and web-based tools, it is evident that these approaches provide diverse strategies for promoting active participation, collaboration, and critical thinking among students. By leveraging technology to create dynamic and interactive learning environments, educators can effectively cater to the needs and preferences of today's digital learners (Dori et al., 2005).

Blended learning combines face-to-face instruction with online components, allowing students to access resources and engage in activities beyond the traditional classroom setting. Hybrid learning, on the other hand, offers flexibility by integrating synchronous and asynchronous online elements to complement face-to-face interactions. Flipped classrooms shift the focus from passive learning to active engagement, with students acquiring foundational knowledge

outside the classroom and participating in collaborative activities during class time. Gamification harnesses game elements and rewards to foster motivation, goal-setting, and enjoyment in the learning process. Lastly, web-based tools facilitate interactive presentations, collaboration, and information sharing, empowering students to become active creators and contributors of knowledge.

By incorporating these technology-enabled active learning approaches into instructional practices, educators can create dynamic and learner-centred environments that inspire curiosity, promote critical thinking, and deepen understanding (Draper et al., 2002). These approaches provide opportunities for students to develop essential skills such as communication, problem-solving, and digital literacy. Additionally, research has shown that these approaches can positively impact student engagement, motivation, and academic achievement.

However, it is important to note that successful implementation of these approaches requires thoughtful instructional design, pedagogical strategies, and consideration of the unique context and needs of learners. While they all seem to produce an engaged classroom, we need to explore a pedagogical approach to teaching and learning with technology, that makes students active and engaged in and outside the classroom. This research, therefore, will study the Activated Classroom Teaching (ACT) model, a set of 21st-century digital pedagogies. Furthermore, no research has been carried out to explore the impact of the Activated Classroom Teaching (ACT) model, on student learning. Also, this research will seek to discover and hopefully theorize exactly how the ACT pedagogy increases student engagement and academic performance, thereby enhancing student learning. This is the gap that this study hopes to fill. This study will provide guidance to teachers, especially in Nigeria, on how active learning approaches to teaching with technology can impact the classroom engagement of students and increase their academic performance.

## **2.7 Critical 21<sup>st</sup>-Century Skills for Learning**

According to Buckle (2020), 21<sup>st</sup>-century skills are the life and career skills, habits and traits that are very important to the survival of students and their success in today's world. Blewett

(2016a) added that these 21<sup>st</sup>-century skills are a series of higher-order skills and learning dispositions that are required and essential for workplace growth and success and teachers must find a way to weave these skills into their curriculum and their learning experiences. These skills are about encouraging deeper learning and understanding, reasoning and developing the ability to solve problems.

Buckle (2020) designed a framework for describing 21<sup>st</sup>-century skills, necessary for success in today's workplace. He categorised them into three namely Learning skills, Life skills, and Literacy skills. Learning skills are sometimes referred to as the "four Cs" of 21<sup>st</sup>-century learning and are collaboration, communication, creativity and critical thinking (Thornhill-Miller, Camarda, Mercier, Burkhardt, Morisseau, Bourgeois-Bougrine, & Lubart, 2023). Life skills include flexibility, social skills, productivity, leadership etc. Literacy skills include information literacy, technology literacy, media literacy etc. (Buckle, 2020). This section explores how these four Cs play out in teaching and learning, delineates the roles of students and teachers in developing these skills, and showcases examples of how technology-enabled classrooms can facilitate their acquisition.

### ***2.7.1 Collaboration***

Collaboration in the 21<sup>st</sup>-century classroom goes beyond simple group work; it emphasizes the development of essential skills such as teamwork, empathy, and effective communication within diverse groups (Blewett, Quilling, Bulbulia, & Wamuyu, 2011). Technology plays a crucial role in facilitating collaboration among students. Online discussion boards, for example, provide a platform for students to engage in meaningful conversations, share ideas, and collectively solve problems (Berger et al., 2003). By participating in such activities, students learn to listen actively, respect diverse perspectives, and contribute constructively to group discussions.

In addition to online discussions, collaborative document editors offer students the opportunity to work together in real time, enabling them to co-create knowledge and provide feedback to one another. Through simultaneous editing and commenting features, students can engage in collaborative writing, peer editing, and co-constructing knowledge (Lomas et al., 2008). These

digital tools not only enhance collaboration but also promote critical thinking, as students engage in discussions and negotiations to reach a consensus or make collective decisions.

Teachers play a pivotal role in guiding and structuring collaborative tasks within the technology-enabled classroom. They must create a supportive environment that fosters teamwork, cooperation, and mutual respect (Mardi et al., 2021). By setting clear expectations, providing guidelines for effective collaboration, and facilitating group dynamics, teachers can help students develop strong collaborative skills (Lomas et al., 2008). Additionally, teachers can scaffold the collaborative process by assigning roles, setting goals, and offering opportunities for reflection. Reflection allows students to evaluate their collaborative experiences, identify areas for improvement, and develop strategies for more effective collaboration in the future (Ward & Darling, 2012).

For example, after completing a collaborative project using technology, teachers can lead a debriefing session where students discuss their experiences, challenges, and successes. Through guided reflection, students can gain insights into their collaboration process, such as the importance of active listening, effective communication, and compromise. This reflective practice enables students to become more self-aware, evaluate their contributions, and develop strategies to enhance their collaborative skills (Ward et al., 2012).

In summary, collaboration is an essential skill in the 21st century, and technology plays a crucial role in facilitating collaborative learning experiences. Through online discussion boards, collaborative document editors, and other digital tools, students can engage in meaningful collaboration, sharing ideas, providing feedback, and co-creating knowledge (Berger et al., 2003). Teachers have a vital role in guiding and structuring collaborative tasks, fostering a supportive environment, and providing opportunities for reflection. By integrating technology effectively and nurturing collaboration, educators empower students to develop essential teamwork skills and prepare them for success in the interconnected world of the 21st century.

### *2.7.2 Communication*

In the 21st century society, effective communication skills have become increasingly essential for students to succeed in various aspects of life. In technology-enabled classrooms, students have access to a wide range of digital tools and platforms that foster communication skills development. For instance, video conferencing allows students to engage in remote collaboration and communication, enabling them to work with peers from different locations (Singh et al., 2010). Through video conferencing, students can engage in meaningful discussions, share ideas, and develop their ability to articulate their thoughts clearly.

Another avenue for enhancing communication skills in technology-enabled classrooms is through multimedia presentations. Students can utilize presentation software to create visually engaging and informative presentations, incorporating images, videos, and interactive elements (Santiana et al., 2017). By utilizing multimedia, students learn to effectively convey information and ideas, utilizing both verbal and visual communication techniques. This not only improves their ability to communicate effectively but also enhances their digital literacy skills (Ungerer, 2016).

Digital storytelling is another powerful tool for developing communication skills in technology-enabled classrooms. Students can use various digital tools and platforms to create and share narratives that incorporate multimedia elements such as images, audio, and video (Hofman-Bergholm, 2023). Through the process of digital storytelling, students develop the ability to structure and convey a compelling narrative, engage their audience, and deliver their message effectively. Moreover, digital storytelling allows students to cultivate creativity and critical thinking as they plan and organize their stories.

Teachers play a crucial role in facilitating the development of communication skills in technology-enabled classrooms. They can provide explicit instruction on effective communication techniques, such as active listening, structuring coherent arguments, and adapting communication styles to different audiences (Dey, 2022). Modelling effective communication strategies through classroom discussions, presentations, and feedback sessions can also help students understand and emulate effective communication practices. Teachers can provide constructive feedback to students, highlighting areas for improvement and guiding

them toward more effective communication approaches (Ruan, He, Ying, Burkle, Hakim, Wang, & Landay, 2020).

In conclusion, technology-enabled classrooms offer diverse opportunities for students to enhance their communication skills. Through video conferencing, multimedia presentations, and digital storytelling, students develop their ability to express themselves creatively, deliver persuasive arguments, and convey information effectively. With the guidance and support of teachers, students can receive explicit instruction, observe effective communication strategies in action, and receive constructive feedback to further refine their communication skills. By developing strong communication skills, students are better equipped to navigate and succeed in the interconnected and communication-driven world of the 21st century.

### ***2.7.3 Creativity***

In the 21st century, creativity has emerged as a highly valued skill, as it fosters innovation, problem-solving, and adaptability. Technology integration in the classroom provides students with a wide array of tools and resources that facilitate the exploration and development of their creative potential (Agbor, 2008). For instance, digital art tools enable students to experiment with various artistic techniques, express their ideas visually, and create multimedia artworks (Thornhill-Miller et al., 2023). Coding platforms offer opportunities for students to think creatively, solve problems, and bring their ideas to life through interactive digital projects. Additionally, multimedia editing software allows students to combine different media elements such as images, audio, and video to create engaging and expressive digital content (Smith et al., 1999).

Teachers play a crucial role in nurturing creativity within the technology-enabled classroom. By encouraging divergent thinking, teachers can foster a mindset that values and encourages creative exploration. This can be achieved by posing open-ended questions, encouraging students to generate multiple solutions to problems, and promoting curiosity and originality (Miseyanni et al., 2018). Furthermore, teachers can provide students with open-ended tasks and projects that allow for creative expression and problem-solving. These tasks should have flexible guidelines and encourage students to think outside the box, take risks, and explore

unconventional approaches (Swanzy-Impraim, Morris, Lummis, & Jones, 2022). By creating a supportive environment that values risk-taking and exploration, teachers can foster an atmosphere where students feel comfortable expressing their creative ideas.

Moreover, teachers can incorporate collaborative activities that encourage students to work together, share ideas, and build upon each other's creativity. Group projects, brainstorming sessions, and peer feedback opportunities provide students with the chance to collaborate, exchange perspectives, and co-create innovative solutions (Swanzy-Impraim et al., 2022). By facilitating these collaborative experiences, teachers can foster a sense of community and enhance the creative process through collective knowledge-sharing and idea generation.

In summary, technology integration in the classroom offers a multitude of tools and resources that empower students to explore and develop their creative abilities. By providing digital art tools, coding platforms, and multimedia editing software, students can express their ideas in diverse and engaging formats (Misseyanni et al., 2018). Teachers play a vital role in nurturing creativity by encouraging divergent thinking, providing open-ended tasks, and creating a supportive environment that values risk-taking and exploration. Additionally, incorporating collaborative activities allows students to work together, share ideas, and build upon each other's creativity. Through these practices, students can enhance their creative thinking skills, foster innovation, and develop the adaptability necessary to thrive in the 21st century.

#### ***2.7.4 Critical Thinking***

In the 21st century, the development of critical thinking skills is of utmost importance for students to navigate the vast amounts of information available to them and make well-informed decisions. Technology integration in the classroom provides students with opportunities to engage in activities that foster critical thinking. For instance, analyzing data sets allows students to interpret information, identify patterns, and draw meaningful conclusions (O'Reilly, Devitt, & Hayes, 2022). Evaluating online sources enables students to distinguish reliable information from misinformation, developing their ability to critically assess the credibility and validity of sources.

Teachers play a crucial role in guiding students to develop critical thinking skills within the technology-enabled classroom. They can pose thought-provoking questions that encourage students to think deeply, analyze information, and consider multiple perspectives (Meirbekov, Maslova, & Gallyamova, 2022). Facilitating classroom discussions allows students to engage in collaborative thinking, debate ideas, and challenge assumptions. By teaching students to identify biases and fallacies, teachers help them become discerning consumers of information and critical thinkers (O'Reilly et al., 2022).

Technology tools can also be leveraged to support problem-solving and inquiry-based learning, encouraging students to approach challenges through a critical lens. For example, virtual simulations allow students to explore real-world scenarios, make decisions, and analyze the consequences of their choices (Ben Ouahi, Lamri, Hassouni, Ibrahmi, & Mehdi, 2022). By engaging in such activities, students develop their analytical skills, learn to evaluate multiple options, and consider the implications of their decisions.

In addition, technology tools can provide scaffolding and support for students as they engage in critical thinking activities. Digital platforms can offer prompts, guiding questions, and resources that facilitate the process of analyzing information and developing critical thinking skills (Meirbekov et al., 2022). By integrating technology effectively, teachers can provide students with access to a wealth of information and tools that enhance their ability to think critically and make informed decisions.

In conclusion, technology-enabled classrooms offer numerous opportunities for students to develop critical thinking skills. Engaging in activities such as data analysis, source evaluation, and virtual simulations allows students to practice critical thinking in authentic contexts. Teachers play a pivotal role in guiding students by posing thought-provoking questions, facilitating discussions, and teaching them to identify biases and fallacies (Blewett, 2016a). Furthermore, technology tools can be leveraged to support problem-solving and inquiry-based learning, providing students with scaffolding and resources to enhance their critical thinking abilities. By integrating technology effectively and fostering a culture of critical thinking, educators prepare students to navigate the complexities of the 21st century and make informed decisions based on careful analysis and evaluation.

The four Cs of 21st century learning—collaboration, communication, creativity, and critical thinking—are integral skills for students in today's interconnected world. Technology-enabled classrooms offer a wealth of opportunities for students to develop and practice these skills in authentic and engaging ways. Through collaborative projects, effective communication channels, creative outlets, and critical thinking activities, students can acquire and refine these skills. Teachers play a vital role in guiding and facilitating the development of the four Cs by structuring tasks, providing feedback, and modelling desired behaviours. By integrating technology effectively, educators can empower students to become active learners, critical thinkers, effective communicators, and collaborative problem-solvers, equipping them with the essential competencies for success in the 21st century.

## **2.8 COVID-19 and E-Learning**

The COVID-19 pandemic which hit the world in the early months of 2020 has had a significant impact on every area of living. Its impact on the economy, industries and production chain, transportation and even the food industry has been quite enormous. According to Hermawan (2021), COVID-19 has come to change the way we live and work and this is for good. Expectedly, the pandemic has also impacted the education system worldwide, with schools and universities at that time closed or operating with limited capacity (Maatuk, Elberkawi, Aljawarneh, Rashaideh, & Alharbi, 2022), to prevent the spread of the virus. Several schools across the globe were not prepared for the changes they would need to make to adapt to the situation that came upon the world and affected the education system. Several schools had to find ways by which they can continue to teach their students, despite that students could not physically go to school to learn. Therefore, in response to the pandemic and the need to make adjustments, many institutions turned to e-learning as a means to continue teaching and learning (Hermawan, 2021). E-learning refers to any form of learning that uses electronic technology. It is the type of learning carried out digitally, using electronic media and typically involving the internet. According to Almaiah, Al-Khasawneh and Althunibat (2020), e-learning is the process of sharing and acquiring knowledge through various electronic channels

on the internet. These channels include educational apps, social media platforms, webinars, video conferencing tools, learning management platforms etc.

The shift to e-learning for most schools has been challenging for both teachers and students. As discussed in a previous section, many teachers have not been trained to teach with these technologies. Even though the tools are available and sometimes free to use, they do not know how to teach effectively with them (Singh et al., 2010). This has made teachers struggle with technology rather than focus on the teaching itself. As reported by Armstrong (2011), teachers complain of spending up to half of their class time getting students to settle down and log in to the teaching platform before any teaching can be done. Blewett (2016a) who was excited about the online simulated classroom which he created in second life, soon became frustrated because the entire class time was over before the students could manage to find a virtual seat and move their little avatars to sit. Other teachers complain about the difficulty in performing assessments using digital media and the integrity of work turned in by students (Armstrong, 2011). Additionally, teachers have had to adapt their teaching content and methods to suit the online environment. While having a note and a few charts was sufficient to teach in a face-to-face environment, teachers needed to re-evaluate their teaching content and find or create either videos, e-books or other digital materials for suitability in the online space (Zheng et al., 2016). This has been a challenge for most teachers especially those who are not tech-savvy; the learning curve can be a steep one.

Likewise, students have also had their share of challenges with learning online. From a lack of access to the necessary technologies to having poor or no internet connections, students have found it difficult to participate fully in online classes. One student (Qurotul-Aini, Mukti-Budiarto, POH-Putra, & Untung-Rahardja, 2020) lamented how she has not been able to participate at all because she did not own a smartphone and has been left out of all the classes. Another student (Nguyen & Duong, 2021) who had a laptop complained of a bad network and how he had been logged out so much from the online class repeatedly. Furthermore, students complain about the potential distraction that learning online poses. According to a student, while trying to concentrate in an online class, a chat can come in from Facebook or Twitter which then becomes a distraction to the student (Vershitskaya, Mikhaylova, Gilmanshina,

Dorozhkin, & Epaneshnikov, 2020). Students have had to devise different means of blocking those distracting apps at certain times of the day when they should be concentrating and learning. All these are challenges that teachers and students have faced with e-learning.

Despite the challenges, e-learning has some significant advantages. For e-learning to produce the kind of results we want it to, it must be done appropriately. Teaching with technology must be done in such a way that students are active and engaged while learning. As discussed previously, e-learning must not be done using ‘death by PowerPoint’, binge-watching videos and e-books on tablets. A right pedagogical approach to teaching effectively with technology must be taken if effective learning must take place (Hew et al., 2020). This study, therefore, seeks to examine the impact that the ACT set of pedagogies would have on students’ ability to learn effectively. According to Qurotul-Aini et al. (2020), e-learning has made it easy to accommodate the needs of different students. E-learning provides the flexibility of learning that makes students learn anywhere and at any time, without being limited to specific times or schedules. In addition, it allows for updated content and encourages content relevance. Content that is in textbooks can only be revised after a few years and only by the author but e-learning allows such content to be constantly up to date. Current events and happenings can become part of the content of the course and are examinable, as one lecturer said (Zheng et al., 2016). Another benefit of e-learning is that it is quick, consistent and cost-effective. Not only is e-learning easily accessible, but the time it takes for students to learn is also reduced by up to 60% (Vershitskaya et al., 2020). Individual students can speed up videos and watch them at their own pace. E-learning even cuts off travel time as students do not need to travel to or from school before they can learn.

Additionally, e-learning reduces the amount spent on physical structures and infrastructures, while providing a stable and effective learning environment online for students (Daniel, 2020). With the use of e-learning strategies like blended learning, hybrid learning and flipped classroom and an appropriate technology-enabled learning pedagogy like the ACT model, teachers can create an effective, engaging and fun learning experience for their students. The immediate and volatile effects of COVID-19 may have waned but the opportunities created to learn using e-learning have remained in many educational institutions. This has become

imperative because of the 4th and 5th Industrial Revolution that has come upon the globe. In the next sessions, the 4th and 5th industrial revolution and their implication on education will be considered.

## **2.9 Professional Development Training for Teachers**

In the era of technological advancements, the integration of technology in education has become a critical aspect of enhancing teaching and learning processes. However, for technology to be effectively utilized in the classroom, teachers must be adequately prepared and equipped with the necessary knowledge and skills (Kennedy, Krause, Judd, Churchward, & Gray, 2006). Professional development training plays a vital role in empowering educators to embrace technology and effectively integrate it into their pedagogical practices. This section reviews the literature on professional development training for teachers, highlighting its significance in preparing educators to teach with technology and promoting positive educational outcomes.

Professional development training encompasses a range of activities and initiatives designed to enhance teachers' knowledge, skills, and pedagogical practices. It serves as a platform for educators to acquire the necessary competencies to effectively utilize technology in their classrooms. According to Gardner (2010), professional development programs aim to provide teachers with the necessary instructional strategies, technological skills, and theoretical frameworks to foster effective technology integration. These programs typically offer a combination of workshops, seminars, collaborative learning experiences, and ongoing support to ensure sustained professional growth.

The quote, "Technology won't replace teachers, but teachers who can teach with technology will replace those who can't," emphasizes the significance of professional development training in the context of technology integration (Trucano, 2015). While technology has rapidly transformed the educational landscape, it is the teacher's role in harnessing technology to enhance instruction that remains paramount. Teachers need more than technical proficiency; they require pedagogical knowledge and innovative strategies to leverage technology effectively (Guskey, 2014).

Research has consistently highlighted the positive impact of professional development training on teachers' abilities to integrate technology into their instructional practices. For instance, in a study by Ertmer, Ottenbreit-Leftwich and Tondeur (2015), it was found that teachers who participated in technology-focused professional development programs demonstrated increased confidence, knowledge, and skills in using technology for instructional purposes. Such training not only enhances teachers' technological competencies but also empowers them to design engaging and interactive learning experiences that promote student engagement and academic achievement.

Effective professional development training for technology integration goes beyond teaching teachers how to use specific devices or software. It also emphasizes the integration of active pedagogical approaches that align with the intended educational outcomes (Kennedy, 2016). Active learning pedagogies, such as the ACT pedagogy, promote student-centred and participatory learning experiences. By incorporating these pedagogies into professional development programs, teachers are better equipped to foster student engagement, critical thinking, and collaboration in technology-rich classrooms (Guskey & Yoon, 2009).

Professional development training plays a pivotal role in preparing teachers to effectively integrate technology into their instructional practices. By providing educators with the necessary knowledge, skills, and pedagogical approaches, professional development programs empower teachers to leverage technology to enhance student engagement and promote positive academic outcomes (Desimone & Pak, 2017). As technology continues to advance, ongoing and targeted professional development training will remain essential to ensure that teachers can embrace technology confidently and utilize it as a powerful tool for facilitating meaningful learning experiences.

## **2.10 History and Trend of the Industrial Revolutions**

An industrial revolution is an inevitable occurrence that is caused by rapid changes and has the potential to alter the way humans live, work and relate to one another (Mkwanazi & Mbohwa, 2018). According to Regenesys business school, an Industrial Revolution has two components; the first is the creation of a new technology while the second is the change in production

brought about by the technology. Every time a new technology is invented, there is a change in the production process and this making process improves greatly with the creation of the new technology (Nankervis, Connell, Cameron, Montague, & Prikshat, 2021). So, as we move from one revolution to the next, multiple new technologies are created and the process of manufacturing accelerates exponentially. Another thing to note is the speed at which these revolutions are unfolding and the massive impact they are having on humans and how we interact (Noack, 2020).

The first Industrial Revolution (IR) which began around the 1780s and lasted about 200 years (Noack, 2020) used steam and water to mechanise the production of systems, replacing the agricultural and manual societies. According to The CEO Magazine (2022), the second IR used electric power and oil for mass production and division of labour was applied. This revolution saw the invention and rise of automobiles and aircraft. In the third IR which began in the 1960s, computers, electronics and information technology were used to automate production (Noack, 2020). This made the earliest journeys into space possible on less computing power. Now we are at the brink of a fourth IR, which builds on the third one and uses a range of digital disruptive technologies to blur the intercession between the physical, digital and biological spheres (Schwab, 2016).

One trend to note, however, which will help our understanding of the subsequent revolutions is the intimacy of technology (Stephanie M. Noble, Martin Mende, & Dhruv Grewal, 2022). In the 1IR, steam machines were large equipment housed in manufacturing houses and massive factories and had thousands of humans operating them. With the invention of the combustion engines and the telephone of the 2IR, we became a little more closely connected to these technologies and ourselves. The 3IR brought about an even closer intimacy with the technology with the invention of personal computing and the technologies became smaller (Nankervis et al., 2021).

### ***2.10.1 The 4th Industrial Revolution (4IR) and Education 4.0***

As discussed above, the fourth Industrial Revolution connects us in a big way through our smart devices to most of the planet. The 4IR was around in the year 2000 and was dubbed the

“Internet of Things” (The CEO Magazine, 2022). The sensors started getting smaller and much more connected. It featured the ubiquitous connectivity of machines, devices and people, producing unlimited information that travels very swiftly and effectively (Schwab, 2016). As seen in figure 2.8, the 4IR saw the invention of technologies such as artificial intelligence, blockchain, the Internet of Things, virtual reality, big data, 3D printing, robotics etc (Wigmore, 2020). Furthermore, Grewal, Kroschke, Mende, Roggeveen and Scott (2020) outlined how technologies like augmented and virtual reality, disembodied robots, avatars, smart windows and smart shelves are radically changing businesses and retailing experiences. This industrial revolution is also already affecting several areas like businesses, government, logistics, finance, healthcare, construction etc. All these sectors are being impacted by the rapid changes caused by the Fourth Industrial Revolution and the right way to respond is being determined by the various industries (Schwab, 2016).

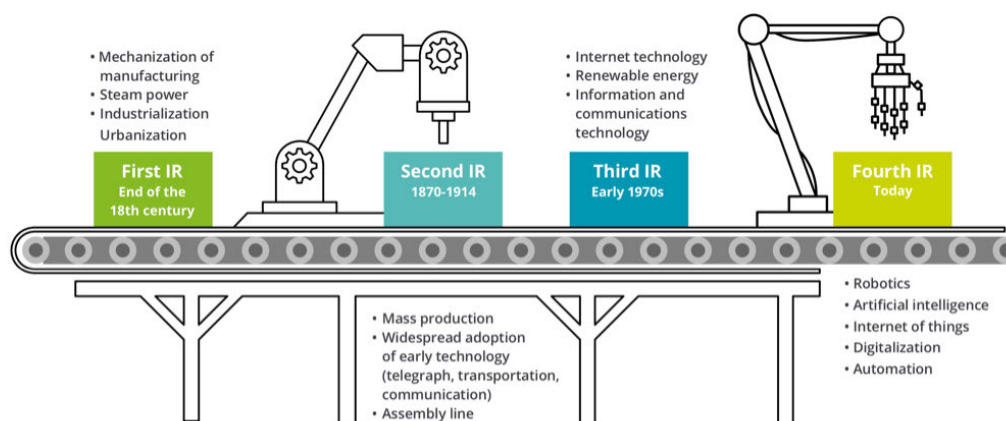


Figure 2.8 Major characteristics of the 1st to 4th Industrial Revolution (Schwab, 2016)

The education sector isn't exempted from this impact. The fourth Industrial Revolution is already having a great impact on how we teach and this is just the beginning. We cannot continue to teach the way we have been teaching, using teacher-based models where children are made to sit through lectures and simply regurgitate information passed (Prather, 2022). According to the Global Business Coalition for Education report, by 2030, students and youths

will be applying for jobs that do not yet exist and would require a different kind of skillset than operates now (Deloitte Global & GBC-Education, 2018). This means we shouldn't teach students just about predetermined curricula and disciplines, but rather teach skills that will be useful for inter-disciplinary jobs and create opportunities for students to chart their learning journey (Marr, 2019).

Students must be engaged and made active in class and this is made possible with the digital technologies that are now available for use in and outside the classroom. Furthermore, pedagogies that take evolving digital technologies into consideration like the Activated Classroom Teaching pedagogy must be applied to make the students socially connected, highly motivated and engaged.

According to Dr Prather, a director of STEM, there are a few things that can be done to educate students in the fourth Industrial Revolution. We must redefine education and change how we think about it. Students must be prepared with skills not to do just a particular job but to do any kind of work, which is necessary for working in the 4IR (Prather, 2022). In the 4IR working environment, the lines between digital and physical will be blurred and so a range of the right set of skills must be learnt to navigate life and work. Everything from creativity, problem-solving, critical thinking, presentation and communication skills to more technical skills like making a podcast, building wikis, graphic and video editing etc. must be developed. Furthermore, self-management skills like active learning, emotional intelligence, a growth mindset and the ability to embrace change are all going to be useful for work in the 4IR (Marr, 2019).

Dr Prather (2022) further identified that teachers must train independent, life-long learners, who are willing to try and fail, collaborate and drive their learning through their careers by themselves. STEAM (Science, Technology, Engineering, Arts, Maths) subjects must be infused into every level of education given to students. The delivery method must also reflect what the 4IR workplace would look like. This is corroborative of the work done by Blewett (2016b) that content should be participatory and personalised so that students can be allowed to think creatively and apply the knowledge to their learning context.

Preparing students to live and work in the 4IR is a great task for educators in this 21st century but by applying active teaching technologies and pedagogies like the ACT pedagogy, students can be made active in their learning and can remain engaged in the classroom.

### ***2.10.2 The 5th Industrial Revolution (5IR) and Education 5.0***

The fifth Industrial Revolution (5IR) can be summarised as the combination of humans and machines in the workplace (Regenesys Business School, 2020). According to Aryu Networks (2020), the goal of the 5IR is to carefully integrate humans and technology, ensuring that both work together, making life effective and providing benefits for each other. Brain-computer technologies and interfaces will replace the smart devices unto which we tap and speak, thereby reducing the technology size (Noack, 2020). The 4IR was termed the “Internet of Things”, and the 5IR is termed the “Internet of Bodies” (Noble, Mende, Grewal, & Parasuraman, 2022). Machine learning and artificial intelligence are central to the 5IR, which seeks to usher in a “neuro-quantified era” that characterises thoughts and emotions. Speaking further about the future of the 5IR, Elon Musk the CEO at Tesla has accepted that humans are underrated and excessive automation is a mistake (Regenesys Business School, 2020). While robots and machines are much more consistent than humans and better at repetitive precision tasks, humans possess the flexibility, adaptability and critical thinking required to perform advanced tasks. This is where the 5IR provides an effective collaboration between robots and humans (Noble et al., 2022).

Generally, we can succinctly say we are already running behind in adjusting our education needs to the Fourth Industrial Revolution. However, with the gradual progress of the 5IR, more research needs to be done on how the 5IR would impact the educational space and how we must prepare our students for living in that era. Education in the 5IR era, aptly termed Education 5.0 (Lantada, 2020) is the use of new technologies to provide humanised teaching. It is a shift from focusing on technology to focusing on the students. Whereas Education 4.0 focused on the role of 4IR technologies like the internet of things, artificial intelligence, and gamification in the teaching and learning process; Education 5.0 on the other hand focuses on students and adding the human perspective to learning, training students to provide solutions

to social problems using technology (Rahim, 2021). Education 5.0 goes beyond running online classes and having distance learning, it trains students to turn digital transformation into a tool for social transformation. Summarily, as seen in Figure 2.9 Education 5.0 is an ethics and humanism-based education (Ahmad, Sharma, Singh, Gehlot, Priyadarshi, & Twala, 2022) and is the link between digital and technological knowledge and human social and emotional skills (Sydle, 2023).

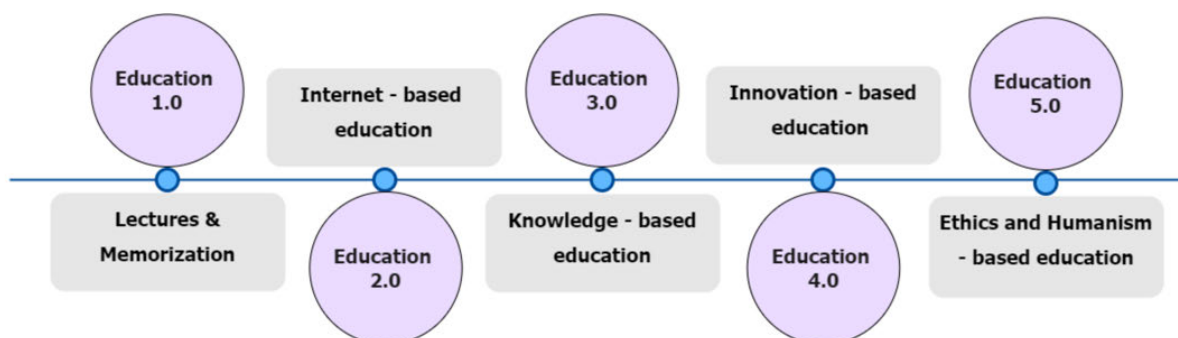


Figure 2.9 Progression of Education (Ahmad et al., 2022)

To accomplish Education 5.0 and integrate it effectively into educational institutions, there must be regular training for teachers (Sydle, 2023). Teachers must be trained not only in technical skills but soft skills so that they are not left behind, teaching students the same way they taught them at the beginning of their careers. Education 5.0 will also require some investments in educational technologies (Togo & Gandidzanwa, 2021). However, these investments in digital software and platforms must be pedagogically integrated for a successful and effective system.

## 2.11 Artificial Intelligence (AI), ChatGPT and Education

Artificial intelligence (AI) refers to the development and implementation of computer systems that can perform tasks that typically require human intelligence (McCarthy, 2007). It involves the creation of algorithms and models that enable machines to process and interpret data, reason, learn, and make decisions autonomously (Marr, 2019). AI has witnessed significant

advancements in recent years, enabling machines to exhibit human-like capabilities in areas such as speech recognition, image processing, natural language processing, and problem-solving.

One of the key aspects of AI is machine learning, which allows computers to learn from data and improve their performance without explicit programming (Elsen-Rooney, 2023). Machine learning algorithms enable AI systems to analyse vast amounts of data, identify patterns, and make predictions or recommendations based on the acquired knowledge (Chen, Chen, & Lin, 2020). This capability has found applications in various domains, including healthcare, finance, transportation, and education.

The impact of AI on society and various industries is profound. In healthcare, AI systems can assist in medical diagnosis, drug discovery, and personalized treatment plans (Hamet & Tremblay, 2017). In finance, AI algorithms can analyse market trends, detect fraud, and optimize investment strategies (Lin, 2019). Furthermore, AI-powered virtual assistants, such as Siri and Alexa, have become commonplace, transforming the way people interact with technology and access information.

However, alongside the numerous benefits, AI also presents challenges and ethical considerations. Concerns related to privacy, security, bias in algorithms, and the impact on employment and societal inequalities have emerged (Gerke, Minssen, & Cohen, 2020). Ensuring transparency, fairness, and accountability in AI systems is crucial to mitigate potential risks and maximize the positive impact of this technology on society.

This is an interesting field which has several implications for humans generally and especially for education. The following sections will consider pieces of literature that discuss Artificial intelligence, ChatGPT and its impact on education.

### ***2.11.1 AI and ChatGPT***

In recent years, artificial intelligence (AI) has become an increasingly popular field of study, with a particular focus on natural language processing (NLP) and chatbots. Chatbots are computer programs designed to mimic human conversation and are often used to interact with

people, answer common queries and questions, and generally provide assistance (Sari, Virnilia, Susanto, Phiedono, & Hartono, 2020). One notable example of a chatbot is Chat Generative Pre-Training Transformer (ChatGPT), a large language model developed by OpenAI that uses deep learning algorithms to generate human-like responses to textual inputs. ChatGPT was launched in November 2022 (Sok & Heng, 2023) and has since become very popular and useful over the past few months. With the advent of ChatGPT-4, the chatbot can now write codes, build apps, design games and improve businesses in many great ways.

Several studies have investigated the effectiveness of chatbots like ChatGPT in various contexts. For example, a study by Miner, Laranjo and Kocaballi (2020) examined the use of a chatbot in the healthcare industry to provide patients with accurate and timely information about COVID-19. The results revealed that the chatbot was able to provide relevant and helpful responses to users' queries, thereby reducing the burden on healthcare professionals and improving patient satisfaction. In another recent healthcare research, Amiri and Karahanna (2022) examined different chatbot use cases in the response of healthcare organisations to the public. Results showed that about 61 chatbots were deployed to handle a different range of COVID-19 response tasks. It was also discovered that it was easy to use and also provided relevant information which provided a complimentary function to public health workers.

Another study by Ruan et al. (2020) explored the use of ChatGPT in the education sector. The authors developed a chatbot that could answer questions related to high school mathematics and evaluated its effectiveness in a pilot study involving 120 students. The results showed that the chatbot was able to provide accurate answers to 76.2% of the questions posed by the students, indicating its potential as a useful learning tool. Students in another research were asked to design a chatbot for MATLAB practical dataset, where students can ask questions and receive accurate answers (Kasthuri & Balaji, 2021). These studies reveal the recent development and impact of artificial intelligence in all spheres of life.

While the use of chatbots like ChatGPT has shown promise in various contexts, there are also concerns regarding their potential negative impacts. For example, some studies have suggested that chatbots could perpetuate biased or discriminatory responses due to the underlying training data used to develop them (Rahman, Faizal, & Suguna, 2017). Additionally, there are concerns

about the potential for chatbots to replace human workers, particularly in industries like customer service.

Overall, the literature suggests that while chatbots like ChatGPT have the potential to provide valuable assistance and improve efficiency in various domains, further research is needed to address concerns related to bias and job displacement. Moreover, as technology continues to evolve, it will be essential to consider the ethical implications of AI and chatbots and ensure that their development and deployment align with societal values and principles.

### ***2.11.2 The Impact of ChatGPT on Education and Learning***

As noted previously, ChatGPT is a chatbot-like language model developed to have human-style conversations and provide human-like responses to prompts and inputs. Its potential positive impact and negative concerns in education have been explored in a few studies, with some focusing on its effectiveness as a learning tool and this subsection will consider a few of them.

A study by Halaweh (2023) investigated the use of ChatGPT in language learning. The authors developed a language-learning chatbot that provided personalized feedback to users' written responses. Students responded to tasks and rather than wait for a lecturer to individually read through all prompts and respond to each one, ChatGPT was employed to provide individual responses to them. The results showed that the chatbot was effective in improving participants' language proficiency and doing it in good time.

Furthermore, according to Hosseini, Gao, Liebovitz, Carvalho, Ahmad, Luo and Kho (2023), ChatGPT can help students present their ideas in an organized and clear form in such a way that students and their teachers can now focus more on generating the ideas and assessing the ideas rather than the presentation. This means the students can even be free to present those concepts and ideas in whichever way they find expressive, whether text, infographics, videos or animations.

In an article by Roose (2023), a high school English teacher asked her students to use ChatGPT to create outlines for an essay they were to write. Once the AI tool generated the outlines, the

students were asked to put away their devices and write the essay, being guided by the outlines generated by ChatGPT. This not only helped the students know how to use the tool but also trained them to know how to prompt it to get what they wanted and to refine it until they got the best outlines suited for the dynamics of the essay (Halaweh, 2023).

Others even used ChatGPT to create suitable assessments and provide personalized feedback to students' responses. One teacher fed an article into the tool and asked it to create 10 multiple-choice questions to assess students' understanding of the article (Sok et al., 2023). Out of the 10 generated by AI, 6 were useable. Another teacher even fed students' essay assessments back into ChatGPT, provided rubrics and asked the AI to provide feedback. As reported by the teacher "The Chatbot even did it better than I would have done it and in a few seconds" (Roose, 2023). During the course of this research, the researcher prompted ChatGPT to write a story given a particular title, that can be used for an English language exam. The generated result is shown in figure 2.10.

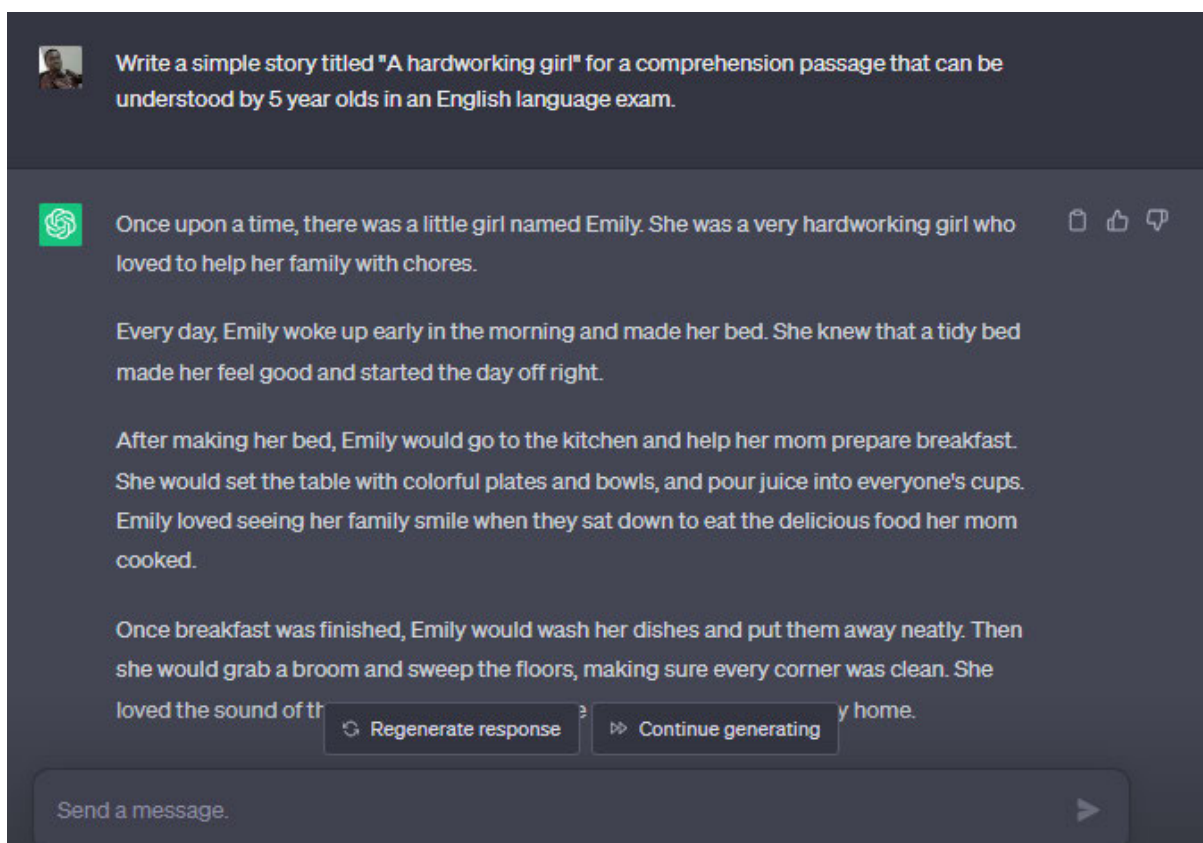


Figure 2.10 An image showing the ChatGPT result from a teacher's prompt

While the use of chatbots like ChatGPT in education has shown promise, there are also concerns regarding their potential negative impacts. Some school districts like the New York City public schools (Elsen-Rooney, 2023) and the Los Angeles Unified (Jimenez, 2023) have banned the use of ChatGPT in their schools for various reasons. One of the major concerns of educators about ChatGPT is the fact that it can aid plagiarism and help students write term papers and essays and pass as theirs. There have been fears of students merely using the AI tool to churn out essays and this may impact the critical thinking skills of students (Choi, Hickman, Monahan, & Schwarcz, 2023).

Another challenge is that chatbots could limit students' opportunities to interact with human teachers and peers, which is essential for the development of social and emotional skills (Sok et al., 2023). Additionally, there are concerns about the potential for chatbots to perpetuate bias and discrimination, particularly if the underlying training data used to develop them is not diverse and inclusive (Sok et al., 2023).

## **2.12 Impact of Technology on Education**

Technology has revolutionised various aspects of society, and its impact on education is undeniable. With the integration of technology in educational settings, new possibilities have emerged for teaching and learning, fundamentally reshaping traditional educational practices (Sancho-Gil et al., 2020). This has made several educational institutions find ways to appropriately integrate technology into their teaching and learning experiences.

The infusion of technology in education has prompted a shift from traditional, lecture-based instructional approaches to more student-centred and interactive teaching methodologies (Graham & Wong, 1993). Interactive whiteboards, multimedia presentations, virtual simulations, and online collaboration tools have revolutionized classroom dynamics, enabling educators to create engaging and interactive learning experiences. Technology-enhanced instruction has shown promise in promoting active learning, critical thinking, problem-solving, and creativity among students (Blewett, 2016b). Moreover, adaptive learning systems and

intelligent tutoring systems have personalized instruction, allowing educators to cater to individual student needs and provide timely feedback.

Additionally, technology has proven to be a powerful tool for increasing student engagement and motivation in the learning process. As highlighted by Parra-González et al. (2021), integrating multimedia elements, gamification, and interactive digital content into curriculum delivery has been found to capture students' attention, foster curiosity, and facilitate deeper understanding. Furthermore, online discussion forums, video conferencing, and social media platforms provide avenues for collaboration, peer-to-peer learning, and global connectivity, enabling students to expand their perspectives and engage in meaningful knowledge sharing (Stead & Colley, 2004).

This section, therefore, explores the literature on the benefits and challenges associated with the use of technology in education and aims to provide insights into its overall impact.

### ***2.12.1 Benefits of Technology in Education***

The use of technology in education has brought forth a wide range of benefits. One significant advantage is the enhanced learning experiences it offers. Through the integration of digital platforms, multimedia content, and interactive simulations, technology creates engaging and immersive learning environments for students (Saunders & Gale, 2012). This dynamic approach promotes active learning, critical thinking, and problem-solving skills among students, ultimately fostering deeper understanding and knowledge retention (Verhaart, 2012).

Furthermore, technology enables personalized learning experiences tailored to the individual needs of students. Adaptive learning systems, intelligent tutoring systems, and learning analytics allow educators to track student progress, identify areas for improvement, and provide targeted interventions (Kasthuri et al., 2021). This personalized approach to education facilitates self-paced learning, individualized instruction, and increased academic achievement.

The integration of technology in education has also revolutionized access to information and resources (Adeboye & Van Staden, 2015). Online libraries, digital textbooks, open educational resources (OER), and massive open online courses (MOOCs) have democratized access to

knowledge, transcending traditional physical boundaries (Ahmad et al., 2022). This increased accessibility fosters lifelong learning, encourages exploration, and enables learners to access diverse and up-to-date information from anywhere, at any time.

In addition to enhancing learning experiences and broadening access to resources, technology promotes collaboration and communication among students and educators (Lomas et al., 2008). Online discussion forums, video conferencing tools, and collaborative platforms enable interaction and knowledge sharing beyond the limitations of physical classrooms. Such collaborative environments foster teamwork, cultural understanding, and global connections, preparing students for the interconnected world they will navigate (Ward et al., 2012).

Finally, the use of technology in teaching and learning teaches students critical technology and professional skills that will be useful for work later in the future. According to Grieger and Leontyev (2021), the use of technology helps students develop skills not only related to learning but other professional skills useful for work. These skills include research skills, communication skills, critical thinking skills, and presentation skills. Grieger et al. (2021) in their article discuss other technical skills including creation skills, design skills, and writing skills all of which are useful for preparing the students for future work.

### ***2.12.2 Challenges of Technology in Education***

However, alongside these numerous benefits, challenges associated with technology in education also need to be addressed. One significant challenge is the digital divide, where disparities in infrastructure and access to technology hinder equal educational opportunities (Adeboye et al., 2015). Students from disadvantaged backgrounds or rural areas may lack access to reliable internet connections, devices, or technical support and this may affect their access to quality education, especially if their academic success is heavily dependent on the use of technology (Mertala, 2020). Bridging these gaps and ensuring equitable access to technology remains a critical concern.

Furthermore, the rapid evolution of technology demands digital literacy skills to navigate, evaluate, and synthesize information critically. Students must develop skills, such as media literacy, information literacy, and digital citizenship (Blewett, 2016b), to be able to learn

appropriately using technology. Additionally, the vast amount of information available online poses the challenge of information overload, requiring learners to develop sorting, curation and critical thinking skills.

Another challenge of the use of technology in the classroom is that of the physical implications on students (Huang, 2020). These physical implications range from distractions to a reduced attention span and problems that affect the eyes. Continuous use of technology to learn can cause students to become addicted to the devices, to the point that they no longer can relate socially with others any more (Riddle et al., 2018). Also, according to Luna-Nevarez and McGovern (2018), the potential overuse of technology can bring a strain on the eye and cause health issues for students.

Additionally, effectively integrating technology into pedagogical practices requires intentional planning and professional development for educators. The successful integration of technology hinges on understanding how to leverage its potential to support learning objectives rather than simply substituting traditional methods (Mertala, 2020). Educators need support and training to navigate the ever-evolving technological landscape and adapt instructional strategies accordingly.

Summarily, the impact of technology on education is multifaceted, with both benefits and challenges. The integration of technology has the potential to enhance learning experiences, promote personalised learning, provide access to information and resources, foster collaboration and communication and teach critical technical and professional skills. However, challenges such as infrastructure disparities, pedagogical integration, digital literacy and physical challenges must be addressed to ensure equitable and effective use of technology in education.

By understanding and navigating these challenges, educators and policymakers can harness the full potential of technology to transform teaching and learning experiences. It is imperative to provide equitable access to technology, invest in professional development, and foster digital literacy skills among students. With careful planning, thoughtful integration, and ongoing evaluation, technology can continue to shape education positively, preparing learners for the demands of the digital age.

## 2.13 Summary

This chapter provides an extensive review of the literature that relates to the topic under consideration. Recall that this study is investigating the impact of using an active pedagogic approach to teaching with technology on student learning. This chapter has, therefore, reviewed various literature that encompasses a range of topics that are crucial to understanding effective teaching practices and the changing landscape of education. This chapter serves as a foundation for the subsequent theoretical and conceptual framework discussed in chapter three.

The chapter begins by examining traditional learning approaches and the limitations they present in terms of student engagement and active participation. It delves into the negative effects of passive technology use in the classroom, highlighting the importance of shifting from a teacher-centred model to a student-centred learning environment. By emphasizing the need for active teaching methods, the chapter emphasizes the role of teachers in facilitating student engagement and fostering critical thinking skills.

Furthermore, the chapter explores the concept of pedagogy, providing a comprehensive overview of active learning pedagogy and its various dimensions. It highlights the benefits of active learning, such as increased student motivation, a deeper understanding of content, and enhanced problem-solving abilities. Additionally, the Activated Classroom Teaching (ACT) pedagogy is briefly introduced as an effective approach to transforming students from passive consumers of information to active producers. This pedagogical framework emphasizes students' ability to curate content, engage in meaningful conversations, learn through correction, create content, and navigate the abundance of information available to them. This pedagogy will be examined in detail in Chapter 3.

In response to the COVID-19 pandemic, the chapter discusses the significant impact on the education system and the swift adoption of e-learning. It addresses the challenges and opportunities associated with the transition to online learning and highlights the importance of educators adapting their teaching practices to effectively utilize technology for remote instruction. The chapter also emphasizes the role of professional development for teachers to

enhance their technological skills and pedagogical strategies, enabling them to create engaging and interactive virtual learning environments.

Moreover, the literature review addresses the impact of the 4th and 5th Industrial Revolutions on education. It explores the transformative changes brought about by these revolutions, such as the increased integration of technology, automation, and the demand for new skills. The literature review underscores the need to prepare students for the future by equipping them with critical thinking, problem-solving, collaboration, and digital literacy skills.

Furthermore, this chapter delves into the potential of artificial intelligence (AI) in education. It explores how AI can be leveraged to personalize learning experiences, provide adaptive feedback, and support student progress monitoring. The chapter also discusses the ethical considerations surrounding the use of AI in education, emphasizing the importance of maintaining a balance between technological advancements and human interaction.

Lastly, this chapter studied the impact of technology on education. It discusses the benefits and challenges of technology in the classroom and in teaching and learning overall. Technology facilitates self-paced learning, individualized instruction, and increased academic achievement for students. On the other hand, technology can negatively affect students physically and can cause distractions to them.

Overall, chapter two provides a comprehensive and in-depth exploration of active learning pedagogy, student engagement, the role of technology, the impact of the COVID-19 pandemic, professional development for teachers, AI in education, and the influence of the 4th and 5th Industrial Revolution. By synthesizing these key aspects, the chapter establishes a strong foundation for the subsequent chapters, contributing to a deeper understanding of the research topic and its implications.

## **CHAPTER 3**

### **THEORETICAL/CONCEPTUAL FRAMEWORK**

#### **3.1 Introduction**

A theoretical/conceptual framework is the discussion of the relevant theories related to the research (Simon & Goes, 2011). It provides a suitable rationale to conduct the study and assures the reader that the type of investigation used is not solely based on the researcher's guesses but is founded on established theories from credible studies (Simon et al., 2011). Furthermore, a theoretical/conceptual framework expresses the interrelationships among various variables important to the subject being investigated. However, while a theoretical framework is existing, tried and previously used, a conceptual framework is used when the researcher combines constructs from various theories and models to form a framework for the study. Therefore, the conceptual framework for this study is the discussion of relevant underlying theories critical to the success and understanding of the problem under consideration. It connects all the variables considered to be essential to the study.

#### **3.2 Activated Classroom Teaching (ACT) model**

According to Blewett (2016a), the Activated Classroom Teaching (ACT) model is a set of “digital age pedagogies that combine active learning and technology affordances into a student-aligned learning approach”. It consists of six 21st-century pedagogies that guide the teacher on how to teach effectively with technology. These pedagogies include Consumption, Curation, Conversation, Correction, Creation and Chaos (Blewett, 2016a) as seen in the figure below. These pedagogies transform students from consuming content to producing content. Students also learn 21st-century skills like Collaboration, Critical thinking, Innovation, Problem-solving, Risk-taking, Curiosity etc. which are all useful in the workplace.

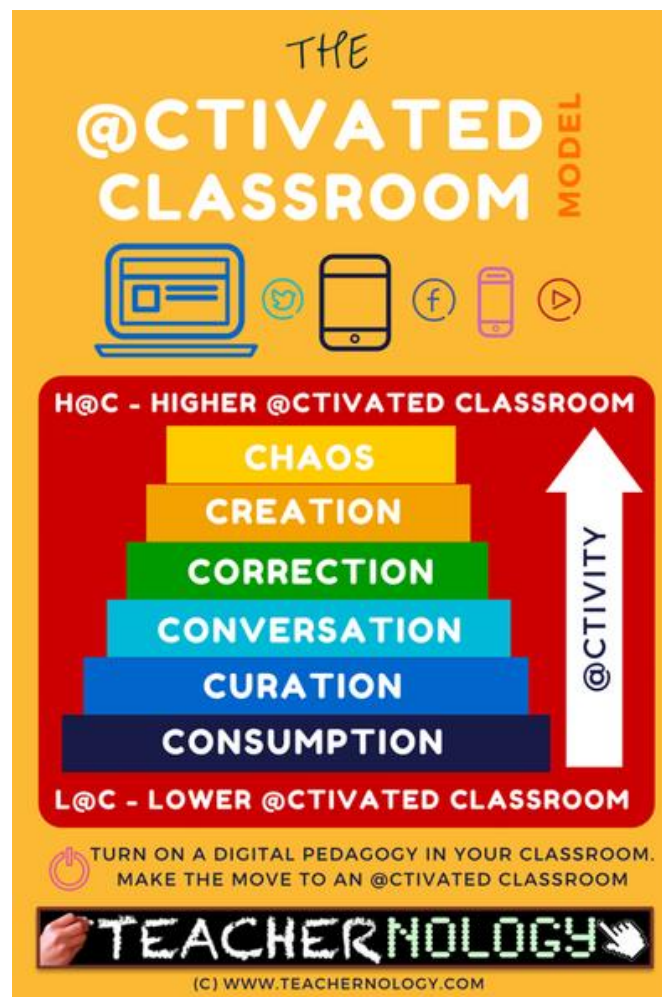


Figure 3.1 Activated Classroom Teaching (ACT) Digital Pedagogies (Blewett, 2016a)

The Activated Classroom Teaching model guides teachers on how to teach effectively with technology. Each of the six layers of the ACT model namely consumption, curation, conversation, correction, creation and chaos, presents opportunities for students to learn while engaging with content in an active way and to produce an artefact. According to Blewett (2016a), the higher you go in the ACT model, the more engaging and active the students become as they seek to learn. Students take control of their learning as they perform various activities in the different layers of the model.

### ***3.2.1 Consumption***

According to Blewett (2016a), the consumption layer has no activity in it. Here, students are simply made to take in and consume content, without necessarily doing anything with it. Even when technology is involved, teachers simply make students consume content. As reported by Reich, Yau and Warschauer (2016), young children may learn from the use of e-books on tablets but this can be more distracting than helpful. According to the researchers, young children learn more from physical interaction with their teachers than from reading e-books on tablets. This perception is corroborated by Willoughby, Evans and Nowak (2015) as they report that preschoolers using paper alphabet books were more likely to say letter names than those students who read the alphabet using eBooks on tablets (Willoughby et al., 2015). Similarly, teachers who present content to students by simply asking them to watch videos on their technology devices, do not significantly get a better result than those who do not use videos (Merkt, Weigand, Heier, & Schwan, 2011).

Blewett (2016a) in his book explains that this is so because by simply consuming content either by reading an eBook or by watching a video, students do not necessarily learn. Merkt et al. (2011) noted that students learned more through the introduction of interactive features in the video. Features that made students pause the video, browse for supporting content and interact with the video were more beneficial to the students and made them understand more. Furthermore, Mischel (2019) while evaluating the features of EDpuzzle, noted that students learnt more after taking the embedded quizzes and the interactive features made them focus more on the important aspects of the video, rather than just flipping through the video.

Therefore, as good as reading eBooks and watching videos in or out of the classroom are, simply using technology for these would not do the magic of effective learning. Learning with technology that will produce effective learning must be more than making students simply consume content (Blewett, 2016b).

### ***3.2.2 Curation***

When learning with technology, curation pedagogy seeks to shift learning from pre-packaged content to engaging students in the process of curating the content they need (Blewett, 2016b).

Verhaart (2012) suggested that technology makes the educator's role change from one of knowledge collection and dissemination to students, to one of curation and dissemination to students. This means educators must be careful to look beyond the one textbook or notebook where the content seems pre-packed to the skills involved in wading through several resources and presenting them to students.

According to Blewett (2016a), curation encourages the development of skills like finding, active reading, filtering and categorizing. These skills are essential skills for both educators and students and take learning to another level. According to the research carried out by Deschaine and Sharma (2015), the five C's involved in digital curation are Collection, Categorizing, Critiquing, Conceptualization and Circulation. These steps are the steps educators need to take to prepare content for their students for effective learning.

In a research carried out on 101 engineering students Aguilar-Peña, Rus-Casas, Eliche-Quesada, Muñoz-Rodríguez and La Rubia (2022) observed that the experience of curation had a great impact on the students and developed skills related to collaboration, digital information management and lifelong learning, in the students. Furthermore, students exposed to digital magazines like Flipboard, which has been curated by the students themselves performed better on the knowledge assessment and were even more engaged than the other students who didn't learn using curated digital content (Luna-Nevarez et al., 2018).

According to Wolff and Mulholland (2013), proper curation is essential to learning and when it is properly done, students can learn more effectively through the process. According to them, for students to learn through curation, research, content selection and collection, content interpretation, content organization and narration are the processes of curation. In the same vein, Blewett (2016a) itemized the curation process as finding, selecting, arranging, amplifying and creating. To even make it more effective for learning, students can be trained to share and engage with others based on the content they have now created (Blewett, 2016a).

Technology makes this easy to do as there are several tools available for students to curate content that will be useful for their learning. As stated in the Luna-Nevarez et al. (2018) research, Flipboard is a great curation tool. Other curation tools include list.ly, storify.com, paper.li, scoop.it, Pinterest, Twitter, etc. (Wolff et al., 2013).

### 3.2.3 Conversation

Proper curation of content many times leads students to naturally want to discuss their findings and share their curated content and knowledge with their colleagues. This leads to the next layer of the ACT model - conversation. The history of conversation in education spans from the Socratic era, which is the pre-printed materials era (Blewett, 2016a). In this era, knowledge resided in the mind of the teacher and could only be accessed by sitting with the teacher and holding conversations with him. This was how learning happened until the Didactic era when knowledge was transferred to books and everyone now had access to it. Unfortunately, this approach to teaching reduced the need for conversations, as students talked less with each other (Graham et al., 1993). Results of their research showed that students taught using more active approaches that allowed the students to discuss and interact with each other had a significant improvement in their reading comprehension performance (Graham et al., 1993).

However, as explained by Blewett (2016b), with the invention of the internet and the digital age, we have been ushered into the Socratic 2.0 era, which is the social era. Now, learning takes place in the conversation (Saunders et al., 2012). Students learn as they interact and hold meaningful conversations around the content. This is different from the lecture-styled approach which pervaded the didactic era and is still seen in most schools today. In a research carried out among teachers and educational psychologists in the UK, Brown and Kennedy (2011) identified that children who had social, emotional and behavioural difficulties had growing changes due to the reflective and exploratory discussions that were going on. Students had the opportunity to interact and collaborate with their teachers and this improved greatly their learning, bringing the required change.

Students in research by Bouton and Garth (1983) were put in learning groups and they learnt through conversations. The students were allowed to formulate questions and test them in conversations with other students. The research showed that students learnt more as they collaborated in those learning groups (Bouton et al., 1983). Furthermore, Ward et al. (2012) took collaboration to another level by integrating two subjects and teaching them together. The research had the two teachers constantly holding conversations as they reflected on their methods, strategies and impact on the students (Ward et al., 2012).

Therefore, the shift from a teacher-centred lecture approach to student-centred conversational-styled teaching and learning increases the engagement level of the students and technology makes this easier to achieve. With conversation tools like Twitter, HipChat, Facebook, Google spaces etc. students can learn by holding conversations around the content.

### **3.2.4 Correction**

The pedagogy of correction as regards learning has to do with the concept that learning happens as students are allowed and encouraged to make mistakes (Chialvo & Bak, 1999). Learning begins from an acceptance that no printed or digital content is without errors and allows students to be free to make mistakes and learn from them (Blewett, 2016a).

In a research that evaluated the factors that influence how medical students learn from their errors, it was discovered that participants were aware of their errors. Students felt they learnt better from actual errors than even from near misses (Fischer, Mazor, Baril, Alper, DeMarco, & Pugnaire, 2006). The research showed that students learned the most when harm was caused. This shows the power of correction and the fact that students learn from making mistakes. Teachers must, therefore, celebrate improvements and growth, rather than success (Blewett, 2016a).

While applying the pedagogy of correction, students must also be encouraged to share their mistakes. This makes them more comfortable with making mistakes and learning from them. This pedagogy of learning encourages students to keep trying and not be afraid of making mistakes, while also learning from the mistakes they make. Some activities that can help in this pedagogy include “Find one - Create one”. According to Blewett (2016a), students are asked to deliberately write a sentence with a mistake in it and also correct one other sentence with a mistake. This helps them critically think about how not to make the mistake so obvious and also think about possible mistakes that can be made. Another activity is the “inverted test” technique, where the teacher gives the students either a fictitious student’s script or a past session’s script and the students are told to mark and spot the mistakes (Blewett, 2016a).

With the use of technology, the pedagogy of correction can be used together with the pedagogy of conversation where conversations can be made around the mistakes made and then students

can learn from it. Technology tools that can be used for correction include wiki spaces, google docs, allourideas etc. These tools encourage students to improve their writing and learning by giving them the space to make mistakes and improve on them.

### **3.2.5 Creation**

The pedagogy of creation begins from the revised Bloom's taxonomy by Lorin Anderson (Anderson et al., 2001), a former student of Bloom. In his revision, Anderson introduced verbs instead of nouns that help students learn. However, he placed 'creating' at the top of the skills. According to Churches (2008), creating is referred to as Higher Order Thinking Skills (HOTS) which include activities like designing, constructing, planning, inventing, making etc. With the use of technology, other skills that are learnt with the pedagogy of creation include filming, animating, publishing, blogging, programming, podcasting, videocasting etc.

The pedagogy of creation that helps to shift students from consumption to creation, improves several skills in the students. According to Blewett (2016a), creating encourages creativity in students, develops project management skills and encourages collaboration and sharing. Students can be involved in projects that help them think, they can collaborate on such projects and develop an artefact from it.

Creation pedagogy encourages students to be producers and not just consumers or curators. Whereas videos are available on YouTube to be watched and used in teaching and learning, it is still essentially consumed (Majekodunmi & Murnaghan, 2012). The creation pedagogy introduces students to going beyond consuming content and encourages them to create theirs. At the end of the activity, something new, an artefact is formed that didn't exist before (Blewett, 2016b). In recent research by Ribosa and Duran (2022), groups of students were asked to create a video that turns the information they have learnt into useful knowledge. According to the research, students perceived improvements in their knowledge and other areas of learning. Other skills learnt included digital technologies, cooperative learning, and skills involved in searching for information and recording voice-overs (Ribosa et al., 2022).

In another research at York University, Majekodunmi et al. (2012) decided to work on a project called "Learning in our own words"; where they created instructional videos for their students.

This spurred their students to also create reflective videos sharing their process of learning. Majekodunmi et al. (2012) discovered that students felt the videos were engaging and helped them learn more, especially hearing the voices of their colleagues. Jaleniauskiene and Kasperuniene (2022) researched the impact of infographics on teaching and learning. Their findings revealed that recent educational practices merged the use of ready-made infographics and those created by the students themselves. Apart from the increased understanding of the content, students also get to learn other career readiness skills like digital and visual information literacy, critical thinking, creativity, communication and collaboration skills (Jaleniauskiene et al., 2022). In another research by Grieger et al. (2021), students were made to create their infographics, choosing topics related to green chemistry. In a semester-long project, the students were asked to amidst other activities review existing infographics, review infographic website makers, design their infographic from the content learnt and finally share their final product on Twitter. The researchers analyzed the project's impact on cognitive gains. The study revealed that students achieved greater cognitive gains in green chemistry knowledge. As reported previously, Grieger et al. (2021) also discovered that the students gained other digital skills while creating the infographics. Technology tools used for creation pedagogy include Powtoon, Prezi, Canva, Piktochart, Scratch etc.

### **3.2.6 Chaos**

The pedagogy of Chaos is the highest point of the activated classroom teaching model and it is the most challenging. At this level, students are provided with the most choices and information but with the least order and control (Blewett, 2016a). In research by Somerville and Green (2011) carried out on primary school students, it was discovered that through organized chaos in outdoor learning environments, deep connections are made and meanings are drawn by the learners. The pedagogy of Chaos is not that of classroom commotion or confusion as it may sound but about learning through meaning-making. According to Doll (2012), chaos is not a place of disorder but a place where order is derived from interactions that come from just the right amount of tension and imbalance. At this level, the teacher deliberately creates some form of confusion and allows the students to figure it out and process the information (Cregan-Reid, 2016).

According to Blewett (2016a), one way by which teachers can increase the learning of students is by removing the control. Rather than provide all the variables, guide and controlled and organized content, teachers can remove all these and allow the students to make meaning from all the variables provided. This kind of pedagogy is suitable for learners who do not seem to perform well in conventional learning environments. Students can make meaning from the diverse information available and draw their learning from there (Somerville et al., 2011).

In the classroom, the teacher can deliberately withhold the formulae or steps and allow the students to figure out the solution. Alternatively, according to Dan Ariely choices can be introduced to make the students think more (Ariely, 2008). Teachers can introduce choices at various layers of the teaching process. Research carried out by MIT's Media lab suggests that students are not being inspired by traditional lectures but they like choices. Furthermore, their brain activities are lower in a lecture than when sleeping (OEB Insights). According to Blewett (2016a), these choices can be a choice of topic, choice of content, choice of tools, choice of approach, choice of presentation and even choice of assessment. These choices provide students with the opportunity to read widely, think critically and analyse as they navigate several seemingly endless options provided to them. These choices also allow students to show their identity and flare as well as display how they learn.

With technology, chaos can be introduced into the classroom using several tools. Coggle ([www.coggle.it](http://www.coggle.it)), Bubbl ([www.bubbl.us](http://www.bubbl.us)), Mindmup ([www.mindmup.com](http://www.mindmup.com)) etc. are all digital mindmap tools, that students can be trained to use to distil their thoughts and brainstorm through a task. Comic creation tools like Pixton ([pixton.com](http://pixton.com)), Write Comics ([writecomics.com](http://writecomics.com)), Witty Comics ([wittycomics.com](http://wittycomics.com)) etc. are digital tools that students can use in and outside the classroom to present their content, wielding the pedagogy of chaos and creation.

### **3.3 Student Engagement**

There is an increase in the research carried out to measure student engagement in schools and what the effect is on the overall effectiveness of the students. Studies have shown that students who have a high engagement level perform better academically and also have higher self-

esteem among peers (Skinner et al., 2007). In defining engagement, several researchers have identified that it is a complex construct that comprises different parameters (Finn & Zimmer, 2012). Basically, it comprises behavioural and affective engagement (Lam, Wong, Yang, & Liu, 2012). Examples of measurement indicators of behavioural engagement include attention in class, participation in class, completion of tasks, attendance in class etc while those of affective engagement include interest in learning, attitude towards learning in school, sense of belonging to school etc (Hart, Stewart, & Jimerson, 2011b). In recent studies, researchers have identified a third construct – cognitive engagement, which can also be used to describe how engaged students are in the classroom (Alrashidi et al., 2016).

Due to this diverse engagement construct, it is difficult to state a comprehensive definition of student engagement. However, for the purpose of this research, engaged students are those who think about how they learn, participate actively in the class, and feel a positive sense of belonging with the school and peers.

Therefore, according to an international research carried out by Hart et al. (2011b) to create a comprehensive measurement tool with which to measure student engagement, there are three student engagement constructs – Affective engagement, Behavioural engagement and Cognitive engagement. The sections below will attempt to define what these constructs mean and the parameters for each construct.

### ***3.3.1 Affective Engagement***

*Affective engagement*, a parameter used to measure student engagement, encompasses students' liking for learning and their attitude towards school (Mangila & Paculaba, 2020). Estell and Perdue (2013) suggest that affective engagement can be assessed by examining students' perceptions of the content being taught, including whether they find it interesting or boring. Additionally, it encompasses students' overall school experience, including their willingness to attend school, their level of happiness within the school environment, and their general liking for the school (Yulia, Sulistyono, & Cahyono, 2020).

Research conducted by Cho and Castañeda (2019) provides evidence that students' affective engagement can be enhanced through the use of specific teaching methods or approaches. For example, in their study, students' enjoyment of learning Spanish courses increased when a grammar-focused mobile application was utilized. This finding illustrates a positive indication of affective engagement among the students involved in the research, indicating that when the teaching approach makes learning interesting and enjoyable, affective engagement is likely to be heightened.

To measure affective engagement in this research, the following parameters were employed:

- The class is boring
- I feel sleepy in class
- I wish the class period was shorter
- I like my teacher
- I like this subject a lot
- I am happy when it is time for this subject

These parameters provide valuable insights into students' affective engagement and help gauge their emotional connection and involvement with the learning process (Mangila et al., 2020).

Overall, the literature suggests that affective engagement plays a significant role in student engagement and academic performance. When students have a positive affective engagement, characterized by an affinity for learning and school, they are more likely to be motivated, attentive, and actively participate in the educational setting. This, in turn, can positively impact their academic performance (Yulia et al., 2020).

Summarily, affective engagement is a crucial aspect of student engagement that involves students' liking for learning and their overall attitude towards school. It can be measured by assessing students' perceptions of the content being taught and their overall school experience. The use of effective teaching methods and approaches that make learning interesting and enjoyable can enhance students' affective engagement. By considering parameters such as the perception of class, sleepiness, desire for shorter class periods, liking for the teacher and subject, and happiness during the subject time, the researcher gained insights into students'

affective engagement levels. Understanding affective engagement is important as it has the potential to influence students' motivation, attentiveness, and ultimately, their academic performance.

### ***3.3.2 Behavioural Engagement***

*Behavioural engagement* is a vital parameter used to assess student engagement as a whole, focusing on observable actions and participation during school, particularly in class (Mangila et al., 2020). It encompasses various aspects, including adhering to rules and regulations, exhibiting effort, persistence, and concentration in class activities and tasks, as well as actively participating in school-wide initiatives (Alrashidi et al., 2016). Lam, Jimerson, Wong, Kikas, Shin, Veiga and Hatzichristou (2014) define behavioural engagement as the level of effort and persistence students invest in their schoolwork. This construct measures the extent of students' participation in the classroom and their dedication to academic tasks. Students who exhibit high levels of behavioural engagement are diligent in both classroom learning activities and extracurricular pursuits.

To measure behavioural engagement in this research, several parameters were employed. These parameters include:

- I like to ask questions when I don't know it
- I like to do homework
- I pay attention in class
- I like to work on my own
- I like to finish my work
- When in class, I pretend to be working

These parameters offer valuable insights into students' behavioural engagement and provide a means to evaluate their active involvement and commitment to the learning process (Mangila et al., 2020).

The literature suggests that behavioural engagement significantly influences academic performance. When students actively participate in class, persist in their efforts, and

demonstrate a strong work ethic, they are more likely to achieve positive educational outcomes. Alrashidi et al. (2016) found that students' behavioural engagement positively correlated with their academic achievement, highlighting the importance of active participation and effort in fostering success. Furthermore, Lam et al. (2014) reported that students who exhibit high levels of behavioural engagement tend to achieve better academic performance and are more likely to meet academic goals.

It is important to note that behavioural engagement is not only limited to academic tasks but also extends to participation in extracurricular activities. Active involvement in school-wide initiatives fosters a sense of belonging and can have a positive impact on overall student development and academic performance. By engaging in extracurricular activities, students have the opportunity to develop a range of skills, such as teamwork, leadership, and time management, which can enhance their academic performance and personal growth (Lam et al., 2012).

Summarily, behavioural engagement is a significant aspect of student engagement that focuses on observable actions and participation during school, particularly in the classroom. It encompasses adherence to rules, effort, persistence, concentration, and active participation in both academic and extracurricular activities. The parameters used to measure behavioural engagement, such as asking questions, completing homework, paying attention in class, working independently, and task completion, provide valuable insights into students' level of involvement. The literature highlights the positive influence of behavioural engagement on academic performance, emphasizing the importance of active participation, effort, and dedication in achieving positive educational outcomes. Furthermore, participation in extracurricular activities can contribute to overall student development and academic success.

### 3.3.3 Cognitive Engagement

*Cognitive engagement*, as a parameter for measuring student engagement, focuses on the students' stress levels and perceptions of learning (Fredricks, Blumenfeld, & Paris, 2004). It involves the persistence to solve problems, a preference for challenging work, and a positive attitude towards failure (Skinner et al., 2007). Cognitive engagement encompasses the students' ability to engage in deep thinking about their learning, employ effective strategies to tackle difficult academic tasks and make connections between new information and existing knowledge and experiences (Hart et al., 2011b).

Students who exhibit high levels of cognitive engagement actively participate in the learning process by engaging in critical thinking, reflecting on their learning, and developing a deeper understanding of the content (Lam et al., 2014). They demonstrate resilience in the face of challenges, refusing to give up on learning and seeking alternative approaches to acquiring knowledge. These students employ cognitive processes to analyze and comprehend topics, actively determining what they can learn from the material at hand (Appleton, Christenson, Kim, & Reschly, 2006).

Research suggests that cognitive engagement significantly influences academic performance. Students who are cognitively engaged are more likely to have a better understanding of the content being taught and demonstrate higher levels of knowledge retention (Lam et al., 2014). By engaging in deep thinking and employing effective learning strategies, these students develop a stronger foundation of knowledge and skills, leading to improved academic performance. Furthermore, the ability to connect new information with existing knowledge and experiences helps students make meaningful connections, enhancing their comprehension and retention of the material (Hart et al., 2011b).

In this research, the following parameters were utilized to measure cognitive engagement:

- If it is too hard, I will skip it
- Some subjects are too hard for me, I will fail
- Even if it's hard, I will try
- I want to do more work

- I try to match what I already know with things I am just learning
- I try to put new knowledge in my own words

These parameters offer valuable insights into students' cognitive engagement levels, providing a means to evaluate their active thinking and strategic approach to learning (Fredricks et al., 2004).

Summarily, cognitive engagement plays a crucial role in student engagement as a whole, encompassing students' stress levels and perceptions of learning. It involves persistence, the willingness to undertake challenging work, and a positive attitude towards failure. Students who exhibit high levels of cognitive engagement engage in deep thinking, employ effective learning strategies, and make connections between new information and existing knowledge. The literature supports the notion that cognitive engagement positively affects academic performance by enhancing students' understanding of content, promoting knowledge retention, and facilitating meaningful connections between concepts. The parameters used to measure cognitive engagement provide valuable insights into students' active thinking and strategic learning processes.

### ***3.3.4 Student Engagement and Academic Performance***

Previous research has consistently demonstrated a positive correlation between student engagement and academic performance, emphasizing the importance of student engagement in fostering positive educational outcomes. Wang and Holcombe (2010) found that students who exhibited high levels of engagement in both classroom and school-wide activities also achieved higher scores on teacher-made tests. Similarly, Wang, Bergin and Bergin (2014) reported that increased academic achievement was associated with higher levels of student participation and engagement in the classroom. These findings suggest that affective, behavioural, and cognitive engagement are key factors contributing to students' academic success.

Affective engagement, characterized by positive attitudes towards school, teachers, and subjects, plays a significant role in influencing academic performance. Students who express liking for their school, teacher, and subject matter tend to be more motivated and invested in their learning, which in turn positively impacts their academic outcomes (Wang et al., 2014).

Additionally, students who perceive their classes as interesting rather than boring are more likely to be actively engaged in the learning process and consequently perform better academically (Wang et al., 2010). By fostering a positive affective connection to school and learning, educators can promote student engagement and enhance academic performance.

Behavioural engagement, characterized by active participation, effort, and persistence in academic tasks, has also been found to have a significant impact on academic performance. Students who exhibit high levels of behavioural engagement, such as paying attention, participating in class, and completing assigned work, are more likely to achieve positive educational outcomes (Wang et al., 2014). Furthermore, students who demonstrate a willingness to seek clarification by asking questions and who persevere in the face of challenges are more likely to acquire a deeper understanding of the subject matter, leading to improved academic performance (Wang et al., 2010). Active participation in learning activities contributes to students' knowledge acquisition and skill development, thereby enhancing their academic achievements.

Cognitive engagement, characterized by deep thinking, strategic learning approaches, and the ability to make connections between new and existing knowledge, is also positively associated with academic performance. Students who engage cognitively in ways such as critically analyzing and mentally processing information, demonstrate a better understanding and retention of the content (Wang et al., 2014). They employ effective learning strategies and actively seek to integrate new knowledge with their existing conceptual frameworks, enabling them to grasp complex concepts and perform well academically (Wang et al., 2010). By fostering cognitive engagement, educators can encourage students to develop metacognitive skills, enhancing their ability to self-regulate their learning and optimize their academic performance.

However, it is important to consider contextual factors that may influence the relationship between student engagement and academic performance. Pagán (2018) conducted a study examining the relationship between student engagement in a music band and academic performance. Surprisingly, the findings indicated that all students, regardless of their reported engagement in the band, performed well academically. This unexpected result may be

attributed to the voluntary nature of participation in a music band. Students who choose to enrol and engage in extracurricular activities like music often possess pre-existing interests and engagement levels, and they may also exhibit higher academic proficiency. Therefore, it is crucial to acknowledge that the relationship between engagement in specific activities and academic performance can vary based on individual and contextual factors.

Summarily, the existing literature consistently highlights a positive relationship between student engagement and academic performance. Affective engagement, behavioural engagement, and cognitive engagement all contribute to students' overall academic success. Positive attitudes towards school, teachers, and subjects, active participation and persistence, and deep thinking and strategic learning approaches are all crucial elements that foster students' educational outcomes. However, it is essential to consider the specific context and individual characteristics when examining the interplay between student engagement and academic performance. By understanding the dynamics of student engagement, educators can implement strategies to enhance engagement and, in turn, optimize academic performance.

The next section considers the conceptual framework adopted for this research. It shows the relationship between the Activated Classroom Teaching pedagogy, student engagement and academic performance.

### **3.4 Conceptual Framework**

This research tested the impact of the Activated Classroom Teaching (ACT) pedagogy on Student Learning, using student engagement and academic performance as learning parameters. The frameworks of the ACT model as described by Blewett (2016a) together with the Student Engagement model in Hart et al. (2011b) have been combined to design the conceptual framework for this research.

The ACT model reveals the relationship across various layers of effective technology use for teaching and learning. According to Blewett (2016b), when technology is used in the classroom, it is simply used for consumption purposes. Students sit passively (in class or outside the classroom) and take in content from a technology device. This, as described by

Mkwanazi et al. (2018) is a sure recipe for disengaged and disinterested students. Rather, teachers can take students through the layers of the ACT model, from Curation, Conversation, Correction, Creation and Chaos; to ensure that they teach effectively with technology.

Furthermore, the comprehensive measurement tool created by Hart et al. (2011b) used to measure student engagement defines three constructs. These constructs - Affective engagement, Behavioural engagement and Cognitive engagement describe three ways by which we can measure how students learn in class, how much they participate in classroom activities and if they feel a sense of belonging with their school and peers. It also describes their tenacity to learn difficult concepts and if they feel comfortable failing and trying again. These describe the engagement levels of students in the classroom.

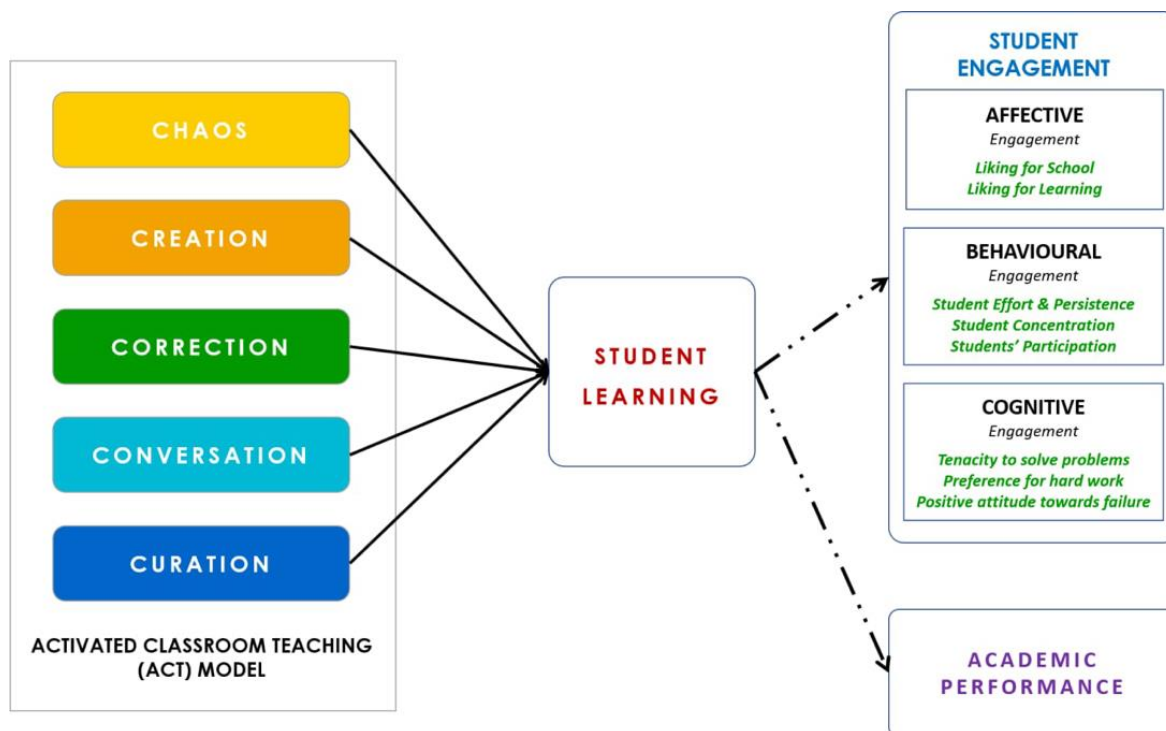
Previous studies also examined the relationship between these student engagement parameters and academic performance. Studies showed that in most cases, students who displayed a higher engagement with classroom tasks and school-wide activities tended to perform better academically as well (Wang et al., 2010).

Therefore, this research proposes a model that combines and extends both the ACT model and the student engagement model to measure the impact of the ACT model on student learning. This is because the ACT model takes into consideration the use and affordances of technology in teaching and learning. As discussed above, the ACT model does not just help teachers and students use technology in the classroom, it guides teachers and students to teach and learn effectively with technology, in and out of the classroom (Blewett, 2016a). Furthermore, the ACT model is student-centred and each pedagogical layer speaks to how students can learn appropriately, effectively and in an engaged manner.

The proposed model considers the relationship between each layer of the ACT model and how students learn. The model points to how teaching using the different pedagogical layers of curation, conversation, correction, creation and chaos increases the students' liking for school and liking for learning. Furthermore, the model examines the relationship between these layers and students' efforts, persistence, concentration and participation in both classroom and school-wide activities. In addition, the model posits that the different layers of the ACT model increase

the students' tenacity to solve problems, making the students desire hard work and have a positive attitude towards failure.

Figure 3.1 shows the conceptual framework designed to suit this research and will be the lens through which this study will be considered.



*Figure 3.2: Conceptual framework for this research adapted from ACT model & Student Engagement Model*

### 3.5 Summary

Having considered the Activated Classroom Teaching (ACT) model and the Student Engagement model, the framework described above will help understand what impact the ACT model would have on student learning; taking increased student engagement and academic performance as success parameters for enhanced student learning. The research will critically examine the different layers of the ACT model, how teaching can be done with this model and how it impacts student learning.

The next chapter will discuss the research methodology used to carry out the study. The research approach, population and sampling, data collection and data analysis procedures.

## CHAPTER 4

### RESEARCH METHODOLOGY

#### 4.1 Introduction

This chapter discusses all the activities involved in carrying out the research. These activities include research design, sampling technique, data collection method and instrumentation, data analysis tools and techniques that helped in fulfilling the stated research objectives. It reviews the research approach, methodology and strategies available and selects the most appropriate for this research.

As stated previously, the following are the specific objectives for carrying out this research:

1. To discover the impact of using the ACT model on student affective engagement.
2. To discover the impact of using the ACT model on student behavioural engagement.
3. To discover the impact of using the ACT model on student cognitive engagement.
4. To discover the impact of using the ACT model on student academic performance.
5. To discover how the ACT model enhances student learning.

To achieve the research objectives stated above, the researcher developed a model that expands the ACT model to help us answer the following research questions:

1. What is the impact of using the ACT model on student affective engagement?
2. What is the impact of using the ACT model on student behavioural engagement?
3. What is the impact of using the ACT model on student cognitive engagement?
4. What is the impact of using the ACT model on student academic performance?
5. How does the ACT model enhance student learning?

The following is the structure of this chapter: Section 4.2 presents the Research Approach and Design. It discusses the main approaches, evaluates their strengths and weaknesses and justifies the choice of this research approach and design. Section 4.3 presents the research methodology and methods used to carry out the research. It presents a discussion of sampling methods and

the various research instruments used in gathering data for the study. Section 4.4 presents the instruments used to gather the data while section 4.5 discusses how data was collected and how it was analysed. Section 4.6 details the ethical approval process while the chapter is summarised in the final section 4.7.

## 4.2 Research Approach and Design

The research approach details the set of plans and procedures outlined that outlines the data collection methods, analysis and interpretation of the results (Creswell, 2003). It involves the research design and research methods to be used to study a topic. The decision on an appropriate research approach is informed by the research problem, the researcher's personal experiences and the audience for the study (Creswell, 2003).

Creswell (2013) identifies three main approaches which can be used for research which are quantitative, qualitative and mixed-method approaches. Whereas the quantitative approach is one in which numbers are important and analysed, the qualitative approach involves the analyses of feelings, experiences and opinions of people (Bhattacharjee, 2012). However, the mixed methods approach employs both qualitative and quantitative approaches. It involves collecting, analysing, interpreting and integrating both qualitative and quantitative data in single research (Creswell, 2013). It may also involve using a distinct design and theoretical framework to properly understand the research problem, where qualitative or quantitative research alone will not suffice (Creswell, 2003).

Therefore, this study made use of the mixed methods approach because of its strengths over the other approaches. This study measured the impact of an intervention on student learning and so quantitative data was gathered, through the use of a questionnaire and analysed. However, to get a deeper understanding of the quantitative results, qualitative data were gathered as well. As explained by Blumberg, Cooper and Schindler (2011), in quantitative research, results are presented in numbers and so are weak in interpreting the context and experiences of the participants. Their personal opinions and that of the researcher are not usually heard in quantitative research (Blumberg et al., 2011). Whereas qualitative approaches make up for this weakness, it inherently introduces the bias caused by the personal opinions

and interpretations of the participants and researcher (Bhattacharjee, 2012). This is what the mixed method approach solves as it uses the numbers in quantitative data to balance and complement the qualitative data in the form of words and narratives (Johnson & Onwuegbuzie, 2004).

This research is a case study that makes use of action intervention research. According to Baum, MacDougall and Smith (2006), action research is research based on reflection, data collection and action. The result of action research is for action to be taken based on the result of the research. According to Creswell (2013), case study research is one in which the researcher explores an activity or process in an in-depth manner. The researcher collects various kinds of data to deeply understand a particular phenomenon, over a bounded period (Creswell, 2013). The ACT model will be the intervention used in this study.

Furthermore, this research makes use of the pragmatic worldview. According to Teddlie and Tashakkori (2010), pragmatists focus their attention on the research problem and use a set of different suitable approaches to derive knowledge about the problem. Pragmatists are not committed to any one system of philosophy and reality; therefore, they make use of mixed methods research where the researchers draw from both the quantitative and qualitative methods in the cause of the research (Creswell, 2003). This research, therefore, uses various approaches to understand the opposing results of the positive and negative impacts of technology on student learning, hence, the pragmatic viewpoint.

Based on the different research approaches and designs postulated by Creswell (2013), table 4.1 shows an overview of the research methodology used in this study.

Table 4.1 An Overview of the Research Methodology

<b>Research Methodology</b>	<b>Description</b>
Research Approach	Mixed-method (Quantitative + Qualitative)
Research Design	Case study, action intervention research
Paradigm	Pragmatism

Sampling technique	Purposive sampling
Data types	Primary & Secondary
Data Collection Method	A questionnaire, focus group discussion, teacher tests, past student results
Participants	Primary level 5 & 6 students of a primary school in Nigeria

### 4.3 Population and Sampling

According to Barratt and Shantikumar (2018), a population can be defined as the entire set of items from which data is drawn for a study or research. In addition, it is the group of people considered for a study, in which the researcher is interested, at a particular time (Barreiro & Albandoz, 2001). The researcher must define in precise terms those that constitute the population he is interested in.

This study was carried out among students in primary five and six and four teachers teaching Mathematics, Verbal reasoning, Computer studies and French; at a private school in Abeokuta, Ogun state of Nigeria. Therefore, the research population for this research included all primary students of the primary school. The entire population for this research is 500 students.

Sampling is very important to the researcher because data cannot be collected from the entire research population. Sampling is the method of selecting a portion from the entire population for research purposes (Acharya, Prakash, Saxena, & Nigam, 2013). Therefore, the researcher needs to select a sample of participants that represents the entire population (Etikan & Bala, 2017) and to reduce greatly or eliminate bias in the data collected (Acharya et al., 2013). There are two main types of sampling which are probability and non-probability sampling. Figure 4.1 shows the various types of sampling techniques that can be used in research:

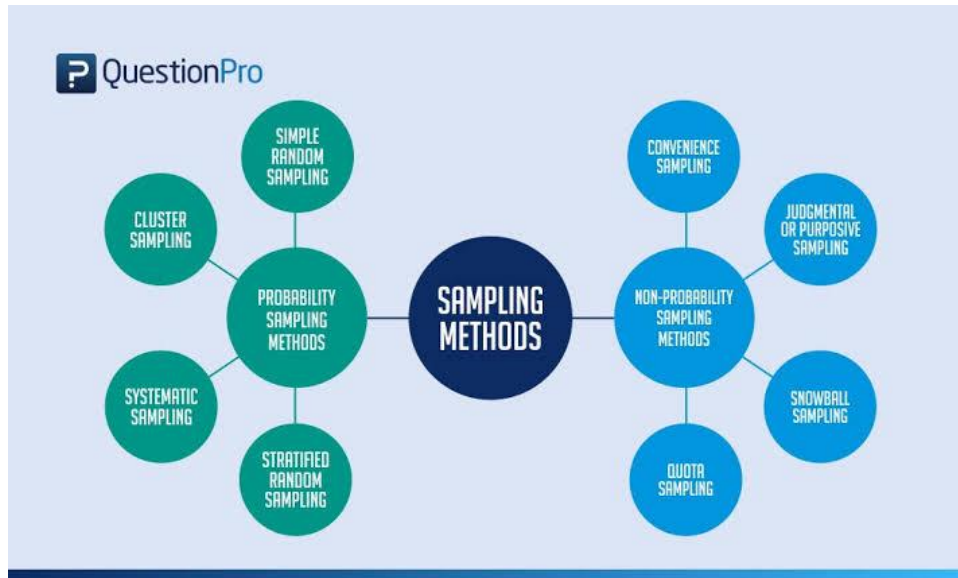


Figure 4.1 The different sampling methods (QuestionPro, 2023)

This research made use of purposive sampling under the non-probability sampling techniques. According to Barratt et al. (2018), purposive sampling is used when the researcher selects the respondents based on certain characteristics. In this research, primary five and six students were purposively selected from the entire population. This is because they are grown and mature enough to participate in the research. The sample size for this research was 91 students and four (4) teachers.

#### 4.4 The Research Instruments

In academic research, the collection of accurate and reliable data is crucial for generating valid findings and drawing meaningful conclusions. Research instruments, also known as data collection tools, play a fundamental role in the research process by providing structured means to gather data from participants (Wilkinson & Birmingham, 2003).

Research instruments refer to the tools, techniques, or procedures used to collect data in a systematic and standardized manner (Wilkinson, 2000). They are designed to capture various aspects of the research variables and facilitate the measurement of constructs or phenomena

under investigation. Research instruments can take multiple forms, including, questionnaires, interviews, observation protocols, psychometric scales, and experimental tasks.

Questionnaires are commonly employed research instruments to gather data from a large sample of participants, allowing for efficient data collection and analysis (Dillman, Smyth, & Christian, 2014). Interviews, on the other hand, offer a more in-depth exploration of participants' perspectives and experiences, providing rich qualitative data (Anderson & Holloway-Libell, 2014). Observation protocols enable researchers to systematically record and analyse behaviours, interactions, or phenomena in their natural settings (Creswell, 2013). Psychometric scales are standardized instruments designed to measure psychological constructs, such as attitudes, beliefs, or personality traits, and ensure the reliability and validity of measurements (Sigerson & Cheng, 2018).

This section, therefore, explores the various instruments used for data collection in this research. This study used a variety of instruments to gather data to glean an understanding of the phenomenon under consideration. These instruments include a questionnaire, focus group discussion, teacher journals, teacher-made tests and even some secondary data. The construction of these instruments would be discussed in the following sub-sections.

#### ***4.4.1 Questionnaire***

The first research instrument used to collect data in this research is the questionnaire. According to Sekeran (2003), a questionnaire is a list of a written set of questions, with a bounded answer set where the respondents simply select the best fit according to their perception. This is an appropriate instrument for cases where the researcher knows exactly what is required and how to measure the variables of interest (Sekeran, 2003).

The research questionnaire for this research as seen in Appendix B, has four (4) sections, labelled Section A to Section D. The questionnaire is introduced to the respondents with a cover letter, explaining the research and what it hopes to achieve, asking for their honest response and assuring them of the confidentiality of their response. Furthermore, at the top of each section, instructions were provided to further guide the students on what to do and how to answer the questions about that section. The first section, labelled Section A and titled

“Demographic Details” was used to collect general demographic information about the respondents. These questions included class, gender and age.

The other sections contained question items to measure the three major engagement factors from the SESQ model. The second section labelled Section B and titled Affective Engagement, was used to measure how the students feel about the affective engagement factors and what impact the active pedagogic approach had on them. In this section, the 5-point Likert scale (1 strongly disagree – 5 strongly agree) was used to test the items in this section. The third section labelled Section C and titled Behavioural Engagement, was used to ask questions that measure the behavioural engagement factors and what impact the active pedagogic approach had on them. In this third section likewise, the 5-point Likert scale (1 strongly disagree – 5 strongly agree) was used to test the items in this section. The fourth section labelled Section D and titled Cognitive Engagement, was used to measure how students feel using the cognitive engagement factors and what impact the active pedagogic approach had on them. In this section, the 5-point Likert scale (1 never – 5 always) was used to test the items in this section.

The researcher ensured that in the design of the questionnaire, the questions in the various sections were properly crafted and worded in such a way that the students would understand and easily identify with each statement. All the questions were crafted as closed-ended questions to ensure accuracy and simplify coding.

### ***Validity and Reliability of the Questionnaire***

Validity and reliability are critical issues when it comes to research instruments. To establish credibility, accuracy and dependability on the findings of the results, validity and reliability must be measured. This is especially true because constructs can be ambiguous and not directly observable (Neuman, 2006).

Validity pertains to the accuracy of a data collection method in measuring its intended target (Middleton, 2019). Furthermore, according to Middleton (2019), content validity is the extent to which the measurement instrument covers all the various aspects of the topic being measured. Therefore, to ensure the content validity of the instrument, the researcher conducted

an extensive literature review and made use of constructs that have been validated and tested in other studies (Hart et al., 2011b). Also, the draft questionnaire was sent to educational technology experts and professors. The draft was also sent to students of that age as a pre-test, to check for wording and any ambiguity that may occur in the questionnaire. The final questionnaire was, therefore, drawn based on the feedback gotten from the experts and students.

Reliability, on the other hand, can be referred to as the consistency with which the method measures the topic under consideration. According to Hair, Black, Babin and Anderson (2010), the reliability of an instrument must give values of 0.7 and above for constructs used. In this research, to ensure the reliability of the instrument, Cronbach's Alpha was used to test and ensure that the values are above 0.7 for the different engagement constructs.

#### ***4.4.2 Teacher Focus Group Discussion***

According to Wilkinson (2000), a focus group discussion (FGD) is necessary when quantitative data does not provide sufficient insights into the phenomenon and it is not easy to have interviews with each research respondent. An FGD also provides in-depth and group insights to understand certain aspects of the research, through the collective experiences and perspectives of the participants (Wilkinson et al., 2003). FGDs have some benefits over other qualitative data collection methods as follows:

- FGDs involve more than one participant and so the responses are richer and can be cross verified
- FGDs allows you to gain similar type of data from more than one participant at the same time
- FGDs are usually conducted in a less formal environment which makes the participants relax and provide correct answers.

This research measured the impact of using the ACT pedagogy to teach with technology on student engagement and academic performance. Respondents for this research are both students and the teachers that taught them using the ACT pedagogy. Therefore, the FGD was

held with the four (4) teachers that participated in the research. During the FGD, the researcher set the agenda and guided the discussion (not controlling it). The researcher had prepared an initial set of 5 questions which were used for the focus group as shown in Appendix B. However, as the discussion progressed, the researcher did ask some follow-up questions to extract more details. The FGD, which lasted for 73 minutes and was audio recorded with the permission of the participants, was then manually transcribed and subsequently analysed to gain further insight and provide supporting qualitative data to the quantitative data gotten from the questionnaire.

#### ***4.4.3 Secondary data***

Secondary data is collected when the researcher needs data that has been previously gotten and stored away (Bryman & Bell, 2007). Secondary data can be used with modification for the new enquiry. This is useful because the researcher does not have to collect useful data all over again. Secondly, secondary data is useful when the conditions under which the previous data was taken are no longer available or are not repeatable.

As a way of reminder, this study measured the impact of using an active pedagogic approach to teaching with technology on student engagement and academic performance. To measure the impact on academic performance, previous academic results of past students were collected. The academic results of the past set of students for the four subjects under consideration – Mathematics, Verbal reasoning, Computer studies and French – in primary five and six were collected. This ensured that the content taught was the same because it was during the same academic term and it was taught by the same set of teachers.

#### ***4.4.4 Teacher-made Test***

To measure the impact of using an active pedagogic approach to teaching with technology on academic performance, at the end of the intervention, a teacher-made test was administered to the students and their academic performance was recorded. This was, therefore, compared with the secondary data collected from the previous academic result.

## 4.5 Data Collection and Analysis Procedures

This study examines the impact of an active pedagogic approach to teaching with technology on the engagement and academic performance of students at a primary school in Nigeria. The student research participants were exposed to the active pedagogic teaching for 7 weeks, in four subjects. These subjects included Mathematics, Verbal reasoning, Computer Studies & French.

### *4.5.1 Data collection procedures*

Before the intervention teaching, a pre-intervention survey in the form of a questionnaire was used to collect quantitative data from the students to test the present engagement level before they were taught using the ACT pedagogy, which is the intervention for this research. Also, secondary data consisting of the past academic result for the previous set of students taught the same content, during the same time was obtained from the school.

During the 7-week intervention period, the four teachers taught the students using the ACT active pedagogic approach. Each week, the teachers taught using one of the various layers of the ACT pedagogy. Week 1 was used to introduce the pedagogy and to revisit the consumption layer. Weeks 2 - 6 were used to teach using the curation, conversation, correction, creation and chaos pedagogy. The different methodologies and technology tools under the different layers were applied each week to teach in an active way and to increase student engagement. Week 7 was used to finalise the teaching and revisit any previous layer. Furthermore, the researcher made critical observations in the classrooms and kept a regular journal of observations and findings.

After the 7 weeks, a post-intervention survey in the form of a questionnaire was re-administered to the students to gather quantitative data from the participants on the engagement of students while the teachers taught with the active pedagogy. Furthermore, to complement the quantitative data gathered, a focus group discussion was held with the teachers to further gain a deeper insight into the data already collected. Also, the reflective journals of the researcher provided further understanding of the phenomenon under study. Finally, a post-intervention

teacher test was administered to the students to see their academic performance after the intervention period and this was compared to the secondary data of past results for further insight into the study.

#### ***4.5.2 Data Analysis Procedures***

The data gathered was analysed and interpreted. The quantitative data gathered via the questionnaire were analysed using descriptive analysis. The data were coded and assigned numbers. These numbers and scores were fed into SPSS for descriptive analysis. The frequencies and percentages were discovered and used to interpret the results. Index categorizations for low and high engagement parameters for each of the engagement constructs were analysed and reported. Also, other appropriate statistical tests like mean, standard deviation and t-tests were used to analyse the marks for each subject under consideration and measure the difference between the pre and post-intervention scores of the students and p-values were used to test the significant levels.

Qualitative data was also analysed, and the FGD was transcribed and reviewed. The researcher identified similarities and recurring terminologies and themes. Categories and themes were drawn from these opinions and feelings of the teachers. Relationships have also been identified and discussed in the subsequent chapters, through the use of graphics and backed up with quotes from the discussion. Thereafter, the results from the analysis of the quantitative and qualitative data have helped to identify the relationships between the active pedagogic approach and its impact on student engagement and academic performance. Further engagement with the data has helped us to find answers to the research questions.

#### ***4.5.3 Analysis of Entire Set of Data***

Summarily, analysing the entire set of data was done in different stages as follows:

1. Review of the entire set of data.
2. Sorting and grouping into relevant themes.
3. Interpreting and drawing of implications.

First, the researcher reviewed the entire set of data, quantitative and qualitative. This helped me to familiarise myself with the entire data set and the results. Next, the data was sorted and grouped based on relevant themes. At this stage, the data was organised into understandable and relatable statements. Finally, interpretation and meanings were drawn from the data and focus was drawn to the implications of the research and how they helped answer the research questions and solve the research problem. Table 4.2 shows the data analysis for each data instrument by each research question.

Table 4.2 Data Analysis for each Data Instrument by Research Question

	Pre/Post-intervention Questionnaire	Teacher-made tests	Secondary data on academic results	Teacher FGD
What is the impact of using the ACT model on student affective engagement?	Mean, index categorisation, WMS			Content analysis & drawing of themes
What is the impact of using the ACT model on student behavioural engagement?	Mean, index categorisation, WMS			Content analysis & drawing of themes
What is the impact of using the ACT model on student cognitive engagement?	Mean, index categorisation, WMS			Content analysis & drawing of themes
What is the impact of using the ACT model on student academic performance?	Mean, standard deviation and difference	Mean, standard deviation and t-tests	Mean, standard deviation and t-tests	Content analysis & drawing of themes

How does the ACT model enhance student learning?	Mean, standard deviation and difference	Mean, standard deviation and t-tests	Mean, standard deviation and t-tests	Content analysis & drawing of themes
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## 4.6 Ethical Approval

Ethical approval was gotten from the ethics committee of the University of KwaZulu-Natal after details of the data collection process were provided to the committee at the time of the approval. Furthermore, gatekeepers' permission was also gotten from the Management of the primary school, whose students and teachers were participants in the research. Finally, the participants were also made aware that participation was voluntary and that they had the right to withdraw at any time from the study.

## 4.7 Summary

This chapter has provided the details of the research methodology for carrying out the study. The mixed-method approach was found to be the best research approach that answers the research questions for the study. The research was designed as an action intervention research to understand the impact of the ACT model which is the intervention for the study.

Quantitatively, a questionnaire was designed and given to the 91 sample students. The results were complemented by the focus group discussion held with the 4 teachers, from a primary school in Abeokuta, Nigeria. Finally, the data analysis procedures were discussed based on the data instrument.

The next chapter presents the results of the study and interprets it.

## CHAPTER 5

### PRESENTATION AND INTERPRETATION OF RESULTS

#### 5.1 Introduction

The previous chapter discussed the research methodology followed and the data collection procedures for this study. This study aims at discovering what impact the use of an active pedagogic approach, like the Activated Classroom Teaching (ACT) model to teaching with technology, will have on the engagement of students and academic performance. This chapter, therefore, will present the results of the descriptive, inferential and multivariate analysis. Section 5.2 will present the pre-intervention and post-intervention results of the demographic distribution of the respondents. Sections 5.3, 5.4 and 5.5 presents the results of the affective, behavioural and cognitive engagement of respondents respectively. Section 6 presents the result of the academic performance of the respondents. Section 5.7 presents the result of the qualitative analysis of the data and the chapter is summarized in section 5.8.

#### 5.2 Demographic Characteristics

The study as shown in table 5.1, presents the pre-intervention and post-intervention percentage distributions of the respondents by class, gender and age. Pre-intervention results show that 91 respondents participated in the study while 92 respondents participated in the post-intervention survey. The reason for the difference is that there was one student who was absent from school the day the pre-intervention survey was carried out and who was now in school during the post-intervention survey.

Table 5.1 Demographic distribution of the respondents

Variables	Pre-Intervention	Post-Intervention
<b>Class</b>		
Primary 5	51(56.0)	51(55.4)
Primary 6	40(44.0)	41(44.6)

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<b>Gender</b>		
Male	44(48.4)	45(48.9)
Female	47(51.6)	47(51.1)
<b>Age (Years)</b>		
09	10(11.0)	-
10	70(76.9)	52(56.5)
11	10(11.0)	37(40.2)
12	01(1.1)	03(3.3)
Mean (sd)	10.02(0.51)	10.48(0.56)

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### ***5.2.1 Pre-intervention results***

From Table 5.1, during the pre-intervention survey, 51 students accounting for 56% of the respondents are in Primary level 5 while 40 students which are 44% are in Primary level 6. This shows that there were more students in Primary level 5 than there were in Primary level 6. Additionally, the results reveal that 44 students which is 48.4% of the respondents were boys while 47 students or 51.6% were girls. Furthermore, 81 students which is 89% of the respondents were 10 years and older while only 10 students (11%) were 9 years of age. At the pre-intervention stage, the mean age of the respondents is 10.02 while the standard deviation is 0.51.

### ***5.2.2 Post-intervention results***

As seen in Table 5.1, post-intervention results reveal that 51 students which is 55.4% of the respondents were in Primary level 5 while 41 students (44.6%) were in Primary level 6. Additionally, 45 students accounting for 48.9% of the respondents were boys while 47 (51.1%) students were girls. Furthermore, the results show that the mean age of the respondents after the intervention is 10.48 while the standard deviation is 0.56.

## **5.3 Affective Engagement of Respondents**

This section will present the results of the affective engagement of the study respondents. As discussed in Chapter 3, affective engagement refers to a liking for learning and a liking for

school. Affective engagement measures how students feel about what and how they are taught and how they feel about their school. These factors tend to affect whether students will be engaged in the learning process or not. Table 5.2 shows the results of the affective engagement with the different statements that measure affective engagement. It is important to note that statements one to three are reversed and so the data shown have also been reversed to reflect their true state and is, therefore, interpreted as such.

Table 5.2 Distribution according to the affective engagement of the respondents

Statements	Pre-Intervention					Post Intervention				
	SD	D	N	A	SA	SD	D	N	A	SA
The class is boring	35(38.5)	11(12.1)	31(34.1)	6(6.6)	8(8.8)	41(44.6)	13(14.1)	27(29.3)	6(6.5)	5(5.4)
I feel sleepy in class	40(44.0)	25(27.5)	12(13.2)	6(6.6)	8(8.8)	39(42.4)	23(25.1)	13(14.1)	10(10.9)	7(7.6)
I wish the class period time is shorter	21(23.1)	18(19.8)	13(14.3)	12(13.2)	27(29.7)	31(33.7)	21(22.8)	16(12.4)	9(9.8)	15(16.3)
am happy when it is time for this subject	10(11.0)	2(2.2)	21(23.1)	16(17.6)	42(46.2)	4(4.3)	3(3.3)	23(25.0)	18(19.6)	44(47.8)
I like the subject a lot	7(7.7)	7(7.7)	10(11.0)	28(30.8)	39(42.9)	6(6.5)	5(5.4)	12(13.0)	26(28.3)	43(46.7)
I like my teacher	8(8.8)	1(1.1)	9(9.9)	12(13.2)	61(67.0)	4(4.3)	1(1.1)	7(7.6)	20(21.7)	60(65.2)

Results show that during the pre-intervention survey, 15.4% of the students agree that the class is boring. However, after the intervention, 11.9% of the students noted that the class is boring. This decrease in the percentage reveals that after the intervention, students felt more engaged because they felt less bored by the way the teacher was teaching in the classroom. Additionally, during the pre-intervention stage, 42.9% of the students wished the class time was shorter. This showed that 42.9% of the students were not engaged in the class, during the pre-intervention

stage. However, after the intervention, 26.1% of the students wish the class time was shorter. This significant decrease shows that after the ACT intervention, students became more engaged in the classroom.

Furthermore, in the pre-intervention stage, 63.8% of the students are happy when it is time for the subject. However, after the intervention, 67.4% of the students are happy when it is time for the same subject. Additionally, the percentage of students who like their teacher increased from 80.2% during the pre-intervention stage to 86.9% after the intervention. These increases in students liking for the subject and liking for the teacher show that the students are more engaged affectively after the intervention than before.

Summarily, table 5.3 shows the index categorization of the respondents' affective engagement. This is calculated by adding the individual item scores for each participant in the six different statements after coding. Strongly disagree is given a score of 1 while strongly agree is given a score of 5. This means a participant can have a minimum score of 6 and a maximum score of 30. A look at the index categorisation table, as shown in Figure 5.3 for respondents' affective engagement, revealed that there is a 3.5% increase from 82.4% to 85.9% in the high affective engagement of the respondents and a 3.5% decrease from 17.6% to 14.1% in the low affective engagement of the respondents, after the intervention. Furthermore, the test of difference analysis shows that the overall mean increased from 22.57 before the intervention to 23.62 after the intervention. There is also a significant p-value of 0.001 for affective engagement. This means that there is a significant impact of the intervention on the affective engagement of the respondents. This means the students were more affectively engaged after the intervention than before the intervention.

Table 5.3 Index-categorisation of respondents' affective engagement

<b>Variables</b>	<b>Categorization</b>	<b>Pre-Intervention</b>	<b>Post Intervention</b>
Low affective engagement	6-18	16(17.6)	13(14.1)
High affective engagement	19-30	75(82.4)	79(85.9)
Total		91(100.0%)	92(100.0%)

## 5.4 Behavioural Engagement of Respondents

This section will present the results of the behavioural engagement of the study respondents. As discussed in Chapter 3, behavioural engagement refers to effort, persistence and class participation in activities and tasks. Behavioural engagement measures how students respond to rules and policies guiding the class and school activities. These factors affect students' engagement in the classroom and thereby affect learning as well. The statements measured here include "I like to ask questions when I don't know it, I like to do homework, I like to work on my own, I like to finish my work, I pay attention in class and When I'm in class, I pretend to be working". These helped the researcher discover what impact the intervention had on the engagement of the students. Table 5.4 show the results of the behavioural engagement with the different statements. It is important to note that statement six is reversed and so the data shown is also reversed and will be interpreted as such.

Table 5.4 Distribution according to the behavioural engagement of respondents

Statements	Pre Intervention					Post Intervention				
	SD	D	N	A	SA	SD	D	N	A	SA
I like to ask questions when I don't know it	16(17.6)	9(9.9)	17(18.7)	16(17.6)	33(36.3)	22(23.9)	10(10.9)	15(16.3)	19(20.7)	26(28.3)
I like to do homework	8(8.8)	4(4.4)	17(18.7)	17(18.7)	45(49.5)	4(4.3)	3(3.3)	13(14.0)	18(19.6)	54(58.7)
I pay attention in class	2(2.2)	2(2.2)	17(18.7)	23(25.3)	47(51.6)	3(3.3)	6(6.5)	21(22.8)	26(28.3)	36(39.1)
I like to work on my own	11(12.1)	10(11.0)	17(18.7)	19(20.9)	34(37.4)	9(9.8)	6(6.5)	29(31.5)	20(21.7)	28(30.4)
I like to finish my work	63(69.2)	17(18.7)	7(7.7)	2(2.2)	2(2.2)	2(2.2)	4(4.3)	8(8.7)	27(29.3)	51(55.4)
When I'm in class, I pretend to be working	66(72.5)	13(14.3)	7(7.7)	1(1.1)	4(4.4)	54(58.2)	13(14.1)	13(14.1)	4(4.3)	8(8.7)

Results from the data show that during the pre-intervention stage, 49.5% of the respondents strongly agree that they like to do homework while 58.7% of the students strongly agree that they like to do homework after the ACT intervention. This showed a significant increase in students' attitudes as far as doing homework is concerned. Similarly, results showed that only 4.4% of the respondent agree that they like to finish their work when they are given a task to perform during the pre-intervention stage. However, after the intervention, 84.7% of the students agree that they like to finish whatever work was assigned to them. This significant increase in the percentage of respondents before and after the intervention shows that the intervention had a strongly positive impact on the students.

However, the results also show that there was a decrease in the attitude of students toward certain behavioural statements. The result reveals that before the intervention, 53.9% of the students like to ask questions when they don't know something. However, after the intervention, 49% of the respondents like to ask questions when they don't know or understand something. The reason for this is unknown but it is noticeable that whereas students love to do homework and to finish their work, they don't want to ask questions when they come across something they don't know. This may be due to perceived shame being felt when their colleagues make fun of them when students ask questions in the classroom. Additionally, 37.4% of the respondents strongly agree that they like to work on their own before the intervention. This percentage decreased to 30.4% after the intervention, maybe because the ACT intervention emphasises collaboration and communication.

Summarily, a look at the index-categorisation of the respondents' behavioural engagement shown in Table 5.5 revealed that even though there is a high frequency of high behavioural engagement before and after the intervention, there is a 3.2% increase in the low behavioural engagement after the intervention and a 2.1% decrease in the high behavioural engagement. Furthermore, the test of difference analysis revealed that there is a 0.82 decrease in the mean from 24.23 before the intervention to 23.41 after the intervention. This means that even though many students are impacted by the intervention and may be behaviourally engaged, there is a slight decrease in that engagement after the intervention.

Table 5.5 Index-categorization of respondents' behavioural engagement

Variables	Categorization	Pre Intervention	Post Intervention
Low behavioural engagement	6-18	10(10.9)	13(14.1)
High behavioural engagement	19-30	81(88.0)	79(85.9)

## 5.5 Cognitive Engagement of Respondents

This section will discuss the results of the cognitive engagement of the respondents. Cognitive engagement has to do with the students' preference for hard work, tenacity to solve problems and take on difficult academic tasks and a positive attitude to failure. Six statements were used to measure the students' cognitive engagement as shown in Table 5.6 using the 5-point scale always, often, sometimes, rarely and never. Statements 1 and 2 - "If it's too hard, I will skip it" and "Some subjects are too hard for me, I will fail" are both reversed and so the results are reversed as well.

Table 5.6 Distribution according to the cognitive engagement of the respondents

Statements	Pre Intervention					Post Intervention				
	AL	OF	SM	RA	NV	AL	OF	SM	RA	NV
If it's too hard, I will skip it	16(17.6)	12(13.2)	30(33.0)	9(9.9)	24(26.4)	25(27.2)	13(14.1)	27(29.3)	8(8.7)	19(20.7)
Some subjects are too hard for me, I will fail	4(4.4)	5(5.5)	19(20.9)	5(5.5)	58(63.7)	1(1.1)	10(10.9)	19(20.7)	15(16.3)	47(51.1)
Even if it's hard, I will try	72(79.1)	7(7.7)	6(6.6)	3(3.3)	3(3.3)	68(73.9)	6(6.5)	13(14.1)	3(3.3)	2(2.2)

I want to do more work	41(45.0)	14(15.4)	21(23.1)	6(6.6)	9(9.9)	37(40.2)	10(10.9)	16(12.4)	10(10.9)	19(20.7)
I try to match, what I already know with the things I am just learning	37(40.7)	14(15.4)	31(34.1)	4(4.4)	5(5.5)	31(33.7)	12(13.0)	35(38.0)	9(9.8)	5(5.4)
I try to put new knowledge in my own word	47(51.6)	13(14.3)	25(27.5)	6(6.6)	-	41(44.6)	9(9.8)	22(23.9)	6(6.4)	14(15.2)

Results in table 5.6 show that there is generally a decrease in cognitive engagement after the intervention for most engagement constructs. Results show that before the intervention, 79.1% of the respondents always try even if they find a concept hard. However, post-intervention results show that 73.9% always try even if they find something hard. This shows a decrease in the percentage of students who are willing to try when they find something hard, after the intervention. Additionally, pre-intervention results show us that 45% of the students always want to do more work while post-intervention results reveal that 40.2% always want to do more work, showing a decrease in those students who want to do more work after the intervention. Furthermore, before the intervention, 51.6% of the respondents always try to put new knowledge in their own words. However, post-intervention results reveal that only 44.6% of the respondents always put new knowledge in their own words. This consistent decrease in most of the statements of cognitive engagement after the intervention, reveals that even though the ACT pedagogy makes students more engaged affectively in the classroom and while learning, this is not the case with cognitive engagement. The test of difference analysis furthermore revealed that there is a decrease from a mean of 23.43 before the intervention to 21.78 after the intervention. The ACT pedagogical intervention doesn't seem to have a positive impact on the cognitive engagement of the students.

## 5.6 Academic Performance of Respondents

Recall that the purpose of this research is to investigate the impact, an active pedagogy like the Activated Classroom Teaching pedagogy would have on student engagement and academic performance. The previous sections have considered the impact the ACT intervention had on student engagement, taking affective, behavioural and cognitive engagement as engagement parameters. The results shown in this section were extracted from the teacher-made tests given to the students at the end of the intervention and compared to secondary data from before the intervention occurred.

This section, therefore, will present the results of the respondents' academic performance, before and after the intervention. This will help to discover the impact of the ACT pedagogy on the academic performance of the students. This section will be presented in five sub-sections, showing the results in the four different subjects used during the research, which are Verbal reasoning, French, Mathematics and Computer studies. The final sub-section will then try to draw a summary of the results of the academic performance of the respondents in this study.

### 5.6.1 Results of academic performance in Verbal Reasoning

The results of the respondents' academic performance in verbal reasoning are shown in table 5.7. Results show that during the pre-intervention stage, 4.3% of the students scored between 50-59 marks while 12% of the students scored the same marks after the intervention. Similarly, 20.7% of the students scored 60-69 marks before the intervention while 21.7% scored those same marks after the intervention. This shows a slight increase in the percentage of students who performed better after the intervention.

Table 5.7 Results of Academic Performance in Verbal Reasoning before and after intervention

Variables (marks)	Pre Intervention	Post Intervention
0-39	0(0.00)	0(0.00)

40-49	0(0.00)	4(4.3)
50-59	4(4.3)	11(12.0)
60-69	19(20.7)	20(21.7)
70 and above	69(75.0)	57(62.0)
Mean	75.77%	70.30%
Sd	9.38	10.10

However, a look at the results shows that 75% of the students score 70 marks and above before the intervention while 62% scored those same marks after the intervention. This is contrary to expectation as it would have been expected that the percentage of students who score high marks should rather increase and not decrease after the intervention. Similarly, the results revealed that the overall mean for the performance of the respondents decreased from 75.77% before the intervention to 70.30% after the intervention. This seeming contrary result could be traced to the fact that the teacher who taught this subject had been previously exposed to the ACT model and had been teaching prior to the intervention with the active pedagogy.

### 5.6.2 Results of academic performance in French

The results of the academic performance of the respondents in French are shown in table 5.8. Results show that fewer students (2.2%) score between 0-39 marks after the intervention as compared to 21.7% who scored the same before the intervention. Additionally, 17.4% of the respondents scored between 60-69 marks before the intervention while 31.5% scored the same marks post-intervention. Similarly, 42.4% of the respondents scored 70 marks and above pre-intervention while 46.7% scored the same 70-above marks post-intervention.

Table 5.8 Results of Academic Performance in French before and after intervention

Variables (marks)	Pre Intervention	Post Intervention
0-39	20(21.7)	2(2.2)
40-49	4(4.3)	5(5.4)
50-59	13(14.1)	13(14.1)
60-69	16(17.4)	29(31.5)
70 and above	39(42.4)	43(46.7)
Mean	67.84%	67.41%
Sd	14.73	12.50

The results show that after the intervention, more students scored a high mark of 70 and above in French. This revealed that the ACT model had a positive impact on the academic performance of the students in this subject.

### ***5.6.3 Results of academic performance in Mathematics***

The results of the academic performance of the respondents in mathematics are presented in table 5.9. The result of academic performance in mathematics is of great importance because students tend to be afraid of mathematics. The results show that 23.9% of the students score between 0-39 marks before the intervention while 12% of the students scored the same marks of 0-39 after the intervention. This reveals that after the introduction of the active pedagogy, fewer students fail the subject.

Table 5.9 Results of Academic Performance in mathematics before and after intervention

<b>Variables (marks)</b>	<b>Pre Intervention</b>	<b>Post Intervention</b>
0-39	22(23.9)	11(12.0)
40-49	14(15.2)	11(12.0)
50-59	27(29.3)	20(21.7)
60-69	15(16.3)	16(17.4)
70 and above	14(15.2)	34(37.0)
Mean	56.15%	64.94%
Sd	13.74	14.89

Additionally, the study results reveal that 15.2% of the students scored 70 marks and above before the intervention. However, after the intervention, 37% of the students scored 70 marks and above. This means that more than double the number of students performed well in mathematics after the introduction of the activated classroom teaching (ACT) active pedagogy, in the teaching of the subject. Summarily, the overall mean percentage distribution shows 56.15% pre-intervention and 64.94% post-intervention. This reveals that there was an increase in the academic performance of students in mathematics, after the active pedagogy intervention; showing that there is a positive impact of the ACT model on the academic performance of respondents. This is quite a novel finding in Mathematics, which indicates that

students seem to work better in Mathematics when there is collaboration as well as when they are using different web-based tools that facilitate an active pedagogical approach.

#### ***5.6.4 Results of academic performance in Computer Studies***

The results of the academic performance of the respondents in computer studies are presented in table 5.10. Research results show a major decrease in the percentage of students who failed computer studies after the intervention. Results show that 17.4% of the students scored between 0-39 marks while no one (0%) scored the same 0-39 marks after the intervention. Furthermore, pre-intervention results reveal that 60.9% of the respondents scored 70 marks and above while after the intervention, the percentage increased to 77.2%.

Table 5.10 Results of Academic Performance in Computer studies before and after intervention

<b>Variables (marks)</b>	<b>Pre Intervention</b>	<b>Post Intervention</b>
0-39	16(17.4)	0(0.00)
40-49	2(2.2)	3(3.3)
50-59	4(4.3)	6(6.5)
60-69	14(15.2)	12(13.0)
70 and above	56(60.9)	71(77.2)
Mean	75.2%	76.48%
Sd	11.16	11.02

This means that the intervention of the ACT pedagogy brought about an increase in the performance of students in computer studies, thereby showing a positive impact. This position is further corroborated by the overall mean percentage of the respondents before and after the intervention. The pre-intervention mean according to Table 5.10 is 75.2% while the post-intervention mean is 76.48%

### 5.6.5 Summary of Respondents' academic performance

The research results, presented in table 5.11, show that there is an increase in the mean from the pre-intervention mean of 240.3 to a post-intervention mean of 272.7. Additionally, there is an increase in the t-values from 27.99 at the pre-intervention stage to 65.04 at the post-intervention stage. Furthermore, there is a recorded p-value of 0.001.

Table 5.11 Test of difference of respondents' academic performance before and after intervention

Variables	N	Mean	Std deviation	t-values	p-values	remarks
Before Intervention	92	240.3	82.99	27.99	0.001	Sig.
After Intervention	92	272.7	40.22	65.04		

These results, therefore, show that there is a significant impact of the activated classroom teaching (ACT) active pedagogy on the academic performance of the respondents.

## 5.7 Qualitative analysis of data

This study is a mixed method study and so consists of both quantitative data and qualitative data collected for the study. As discussed in a previous chapter, the qualitative data was extracted from a Focus Group Discussion and was used to provide additional insight into the quantitative data already extracted from the survey. Results from the FGD which took place with the four (4) teachers who took part in the study, will be presented here in this section.

### 5.7.1 Qualitative analysis process

At the end of the 7-week intervention, a focus group discussion was carried out with the four teachers involved in the study. These teachers taught various subjects namely Mathematics, Verbal reasoning, Computer studies and French. The discussion which lasted for 73 minutes was an engaging one and it was audio recorded by the researcher after due permission was taken. The participants of the FGD were assured of confidentiality and that all comments made

will only be reported and used for research purposes and would not be tied to anyone. The following steps were taken to analyse the data:

**a. Transcribing of audio recording:** The audio was painstakingly and manually transcribed to text, by the researcher. This was because the recording was not very clean and most transcribing software couldn't pick out the voices properly.

**b. Reading of transcript:** Once the transcript was available, the researcher then spent some time reading the transcript over and over to gain an understanding of the discussion. This helped the researcher to become familiar with the text and properly understand the flow of the discussion.

**c. Coding of the transcript:** The next step is to find meaning from the data. This was done by drawing codes from the text. The researcher read through the text and found major words that explain the text and picked out all such codes. The codes were also grouped and from it, major themes were drawn and presented.

### 5.7.2 Code tree

According to Salmons, Lieber and Kaczynski (2019), a code is a word or phrase extracted from a large group of data which describes patterns and relationships. These codes are further studied and grouped to identify themes which explain the data. A code tree, therefore, is a figure showing how the codes were formed from various sections of the text and how the themes were drawn from the codes. The FGD had questions based on two main areas - what the experience of teaching and learning was like before the intervention and what it was like during the intervention. A total of twenty-two (22) codes and six (6) themes were derived from the analysis. However, the codes have been drawn and divided into these two main areas.

#### **Pre-intervention experience codes and themes.**

From the FGD, eleven (11) codes have been drawn from the pre-intervention section of the text as shown in Figure 5.1. These are words and phrases that describe what the discussion was all about. From these codes, three (3) themes have been drawn and will be used to discuss the pre-intervention experience of the teachers and the students. These themes will be examined and

discussed in detail in the next chapter and it will further help us understand the discussion and add to the data already extracted from the quantitative analysis. These themes include:

1. Challenges with teaching methods
  - Boring method of teaching
  - No feedback from students
  - The assessment was stereotyped and boring
  - The teacher is tired out
  
2. Challenges with Students' engagement
  - Produced passive students
  - Chorus answer to questions
  - The teacher is in control of the class
  
3. Challenges with students' creativity and learning
  - Ignored the creativity of students
  - Limit students' thinking
  - Limit students' learning
  - Struggle with certain challenging concepts

Therefore, figure 5.1 shows the code tree used to code the data and how themes are formed for the pre-intervention phase.

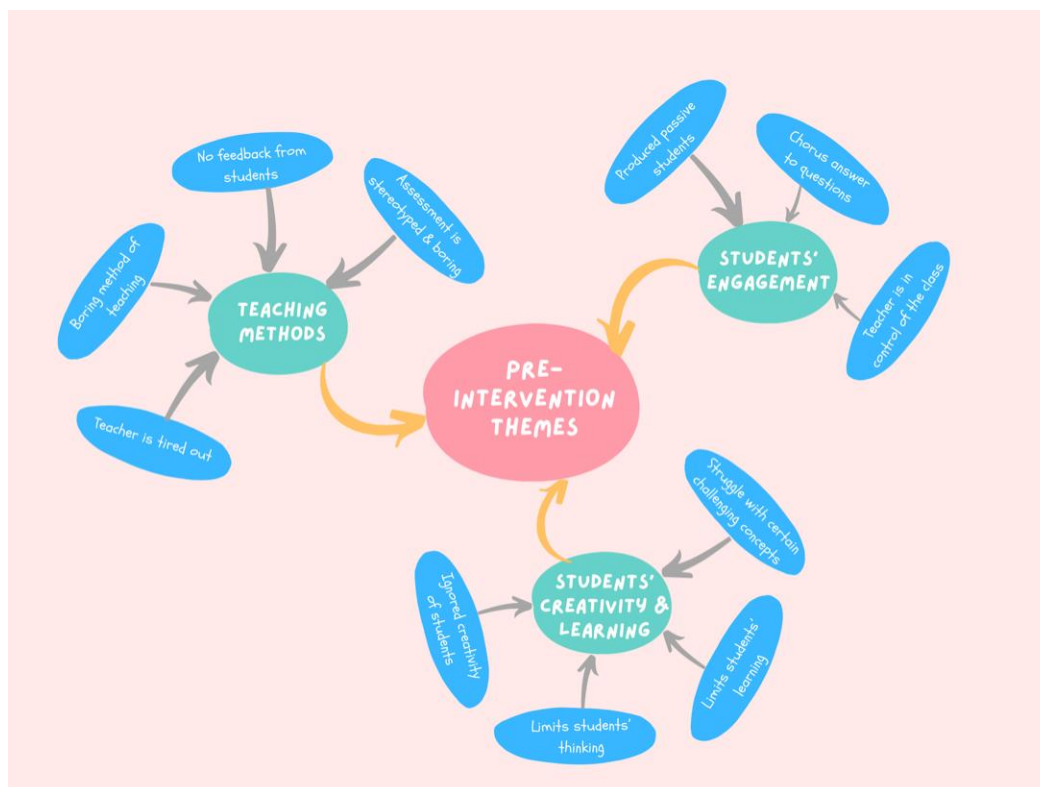


Figure 5.1 Code tree for the pre-intervention student and teacher experience

### Intervention phase experience

From the FGD, eleven (11) codes have also been drawn from the intervention phase section of the text, as shown in Figure 5.2. These are words and phrases that describe what the discussion was all about during that phase. From these codes, three (3) themes have again been drawn and will be used to discuss the intervention phase experience of the teachers and the students. These themes will be examined and discussed in detail in the next chapter and it will further help us understand the discussion and add to the data already gotten from the quantitative analysis. These themes include:

1. Engaging teaching methods
  - Broaden content
  - Increased discussion in class
  - Learning is fun and interesting

- Make learning practical
2. Benefits of active learning
    - Students are active while learning in and out of class
    - Students are able to think
    - Increased student expression
    - Finding each student's voice
  3. Improved learning outcomes
    - Increased recall of content
    - Eagerness to learn
    - Understanding of concepts

Therefore, figure 5.2 shows the code tree for the intervention phase experience of the students and the teachers.

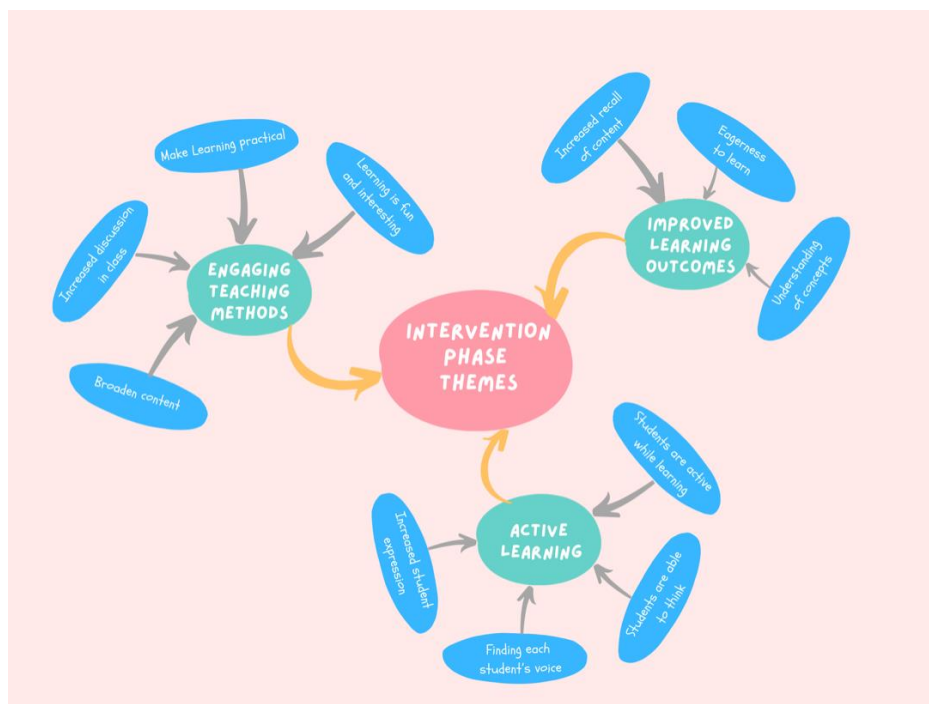


Figure 5.2 Code tree for the intervention phase showing student and teacher experience

### 5.7.3 Word Cloud

A word cloud is a visual representation of words that appear in a piece of text and are used to summarize the content of the document, usually highlighting the most important words (Lee, 2020). The text transcribed from the focus group discussion was fed into an online word cloud generator found at [www.worditout.com](http://www.worditout.com), to visually understand the discussion. Again, as above, the word clouds have been generated based on the two main sections of the discussion and would be presented and subsequently discussed that way. Figure 5.3 shows the word cloud for the pre-intervention experience of the teachers and students and visually shows us what words were important in the discussion.





Figure 5.4 Word cloud showing the major points of the intervention phase experience

As seen in the word cloud, it can be seen that words such as “technology” and “pedagogy” are seen to be important in the discussion amongst others. This means that during the intervention phase of the research, the experience can be described by a class taught with technology and guided by a pedagogy. Other implications would be discussed in chapter 6 of this thesis.

## 5.8 Summary

The researcher has presented the results from the quantitative and qualitative analysis of the data in this chapter. The results of the affective, behavioural, and cognitive engagement have been presented, and so also have the results of the academic performance of the participants presented. Finally, the researcher presented the results of the analysis of the qualitative data, using a code tree and word cloud.

The next chapter, therefore, will further discuss these results and attempt to answer the research questions set out at the beginning.

## CHAPTER 6

### FINDINGS AND DISCUSSION

#### 6.1 Introduction

The previous chapter presented the quantitative and qualitative results of the study carried out. Results of the affective, behavioural and cognitive engagement of the respondents were presented, as well as the academic performances of the respondents in the various subjects. Also, preliminary results of the qualitative analysis were presented using code trees and word clouds. Themes have been identified and presented as well as major points to consider and discuss.

In this chapter, the researcher presents the findings and discusses the results presented in Chapter 5. The chapter will consider an overview of the results, the impact of the Activated Classroom Teaching pedagogy on the affective, behavioural and cognitive engagement of the respondents as well as its impact on the academic performance of the respondents. Furthermore, this chapter will discuss in detail the major themes derived from the qualitative aspect of the study. This helps to answer the research questions stated at the beginning of the research.

#### 6.2 Results Overview

The results of the study show that the engagement and academic performance of the students generally increased after the intervention of the teaching with the activated classroom teaching model.

A summary of the results as revealed by the analysis for each of the research questions is shown as follows:

**Research Question 1:** What is the impact of using the ACT model on student affective engagement?

General finding 1: There is a 3.5% increase in the high affective engagement of the respondents after the intervention.

General finding 2: There is a significant p-value of 0.001 for affective engagement.

General finding 3: The ACT model has a significant positive impact on the affective engagement of the students, after the intervention.

General finding 4: When the ACT model is properly applied to teaching and learning, there is an increase in the students' liking for the subject, liking for the teacher and liking for the school, which are parameters for students' affective engagement.

**Research Question 2:** What is the impact of using the ACT model on student behavioural engagement?

General finding 1: The test of difference analysis revealed that there is a 0.82% decrease in the behavioural mean of the respondents after the intervention.

General finding 2: Even though many students are impacted by the intervention and may be behaviourally engaged, there is a slight decrease in that engagement after the intervention.

**Research Question 3:** What is the impact of using the ACT model on student cognitive engagement?

General finding 1: The test of difference analysis revealed that there is a 1.65% decrease in the cognitive mean of the respondents after the intervention.

General finding 2: There is a significant decrease in the cognitive engagement after the ACT intervention.

General finding 3: The impact of an active pedagogy on the cognitive engagement of students is due to the actual type of activity being carried out in and out of the classroom.

**Research Question 4:** What is the impact of using the ACT model on student academic performance?

General finding 1: There is a 1.04% increase in the average mean of the academic performance of the students after the intervention.

General finding 2: There is a significant p-value of 0.001 for the academic performance of the students

General finding 3: The ACT active pedagogy positively influenced the academic performance of the students.

**Research Question 5:** How does the ACT model enhance student learning?

General finding 1: Teaching appropriately with the ACT model increases student engagement.

General finding 2: Teaching appropriately with the ACT model increases students' academic performance.

### **6.3 Impact of the ACT Model on Affective Engagement of Respondents**

As presented in an earlier chapter, affective engagement refers to students' liking for the subject, liking for the teacher and liking for the school (Mangila et al., 2020). This section will review the results presented in Chapter 5 and further discuss what they mean and how they answer the research questions.

The post-intervention results presented showed that there is a decrease in the percentage of students that felt bored and those that wished the class time was shorter. Furthermore, after the Activated Classroom Teaching model intervention, results revealed that more students are happy when it is time for the subject and they like their teacher. This is consistent with Hargreaves, Elhawary and Mahgoub (2018) that reported that students respected their teachers and were more engaged in the classroom when they liked the teacher. Another student in the same study said "If I like the teacher, I will like the subject she teaches" and surely such a

student will be more engaged in the classroom than one who doesn't like the teacher. This is especially true when the teacher makes use of an active pedagogical approach.

Furthermore, students in another study reported that they have come to like Mathematics because their teacher engaged them with mobile learning apps which they worked on in groups and broadened their understanding (Calder & Murphy, 2018). According to another study conducted on a sample of 120 students, active learning activities were found to be positively associated with students' performance index (Merugu, Archana Reddy, Pamulaparthi, & Juluru, 2023). The study also revealed that students who engaged in active learning reported a higher level of satisfaction with the course delivery and instructor. This suggests that the quality of the learning experience and student engagement can be improved when active pedagogies are applied. Mady and Baadel (2020) also discovered that students who attend schools where multimedia resources are used actively in the classroom, like their school and teacher and are engaged affectively.

Teachers during the focus group discussion commented on how students' likeness for the subject improved after the intervention. For example, one teacher said, "My students are eager for me to use any free period they have, rather than using it to rest" (Participant 1). Another teacher reported how the intervention made the students watch videos at home before coming to class, thereby making them more prepared for the class. The researcher observed how students in a verbal reasoning class where the teacher taught using the ACT pedagogy, would refuse to leave the class because they were fully engaged and loved the subject. This further corroborates that the ACT active pedagogy has a positive impact on student affective engagement.

The index categorization results as presented in Chapter 5 revealed that there is a 3.5% increase in the high affective engagement of the respondents and a 3.5% decrease in the low affective engagement of the respondents. This means that more respondents scored between 19-30 after the intervention and fewer respondents scored between 6-18 after the intervention. There is also a significant p-value of 0.001 for affective engagement. These imply a significant improvement in the affective engagement of the respondents.

### **What is the impact of using the ACT model on student Affective Engagement?**

As stated in Chapter 1, the following research hypothesis on affective engagement was postulated at the beginning of this research:

*H1-a1: The ACT model will have a positive impact on the affective engagement of the students after the intervention.*

From the data extracted, analysed and discussed, this hypothesis is accepted and true. Therefore, the ACT model has a significant positive impact on the affective engagement of the students, after the intervention; which makes this active pedagogy a robust strategy to incorporate into the curriculum and better enhance students' engagement.

Also, the first research question asked in Chapter 1 is stated as follows:

*What is the impact of using the ACT model on student affective engagement?*

There is a significant improvement in the students' affective engagement after the ACT intervention. Using the Activated Classroom Teaching active pedagogy produced a significant impact on how teaching is done and improved the affective engagement of students. When students learn by curating content or by holding meaningful conversations around content face-to-face or in an online environment, this increases their engagement and they become more interested in the subject and school at large. Similarly, having students create content and producing digital artefacts to show for it improves student understanding and also student engagement. This shows that if the ACT model is employed in the approach to teaching and learning, there will be an improvement in how students engage with the content. This will in turn improve how teachers teach and also how students learn.

### **6.4 Impact of the ACT Model on Behavioural Engagement of Respondents**

Behavioural engagement, as stated before, refers to efforts, persistence, concentration and participation in class and school-wide activities (Alrashidi et al., 2016). This section, therefore, will review the results presented in Chapter 5 and further discuss what they mean and how they answer the research questions.

The data presented in Chapter 5 revealed conflicting results. On the one hand, the results show that the ACT model has a positive impact on some of the behavioural engagement statements while on the other hand, there was a decrease in some of the statements after the intervention. The results revealed that there is a significant increase in students' attitudes as far as doing homework is concerned so also do they like to finish their work when they are given a task to perform. This is expected and aligns with the results of previous studies. According to Roehl et al. (2013), students are excited about doing homework when it involves some form of active approach. Students enjoy doing homework when they have to engage in a discussion or chat online. Teachers in a study by Crow and Murray (2020) noticed that students would sign in long before the official time for the class and engage themselves even before the teacher arrives. In another study by Roehl et al. (2013), students report that they would begin to do the homework from school, finish it and even ask for more if it would involve some active learning approaches. In this study, the researcher also observed this when students were given a puzzle to solve as homework. Whereas, previously before the intervention, the teacher would need to coerce or threaten the students to do or perform their homework; the students began to solve the puzzle even before the class ended and several were ready to submit almost immediately. Similarly, students are motivated to finish their work if it involves some active pedagogy. In an article by Liu (2022), students need motivation to finish a task, especially when it is taking longer than it should or they meet difficulties. One way to motivate students to finish tasks is by ensuring the tasks are technology-enabled and that it engages them. According to Pande et al. (2020), students abandon tasks when they lose interest in it. This is in line with another study with a class of 75 students (Bouton et al., 1983). As long as the students were allowed to collaborate and hold conversations around these tasks, they could stay on the task for as long as it takes to finish it. The results also revealed that there was some kind of momentum to keep working as long as there would be a digital artefact created at the end of the tasks.

Whereas after the ACT intervention, students love to do homework and finish their work, they do not want to ask questions when they come across something they do not know. As stated earlier, this may be because students don't want to feel shame. According to Graham et al. (1993), students prefer to ask their peers and find answers their way until they find a solution

to it rather than stand to ask questions. Teachers during the FGD also agreed that students were eager to do homework and finish all tasks. One teacher said, “My students would trouble their parents until they release their devices for them to do and submit their homework” (Participant 2). Another teacher noted that “even when students are unable to do the homework immediately due to lack of resources, even after it might have been graded, they would still do it and bring it for possible grading” (Participant 3). These results were due to the ACT pedagogy employed during the intervention.

However, despite these results, it was noted that even though there is a high frequency of high behavioural engagement before and after the intervention, there is an overall decrease in the high behavioural engagement. Furthermore, the test of difference analysis revealed that there is a 0.82 decrease in the mean from 24.23 before the intervention to 23.41 after the intervention. This means that even though many students are impacted by the intervention and may be behaviourally engaged, there is a slight decrease in that engagement after the intervention.

### **What is the impact of using the ACT model on student Behavioural Engagement?**

As stated in Chapter 1, the following research hypothesis on behavioural engagement was postulated at the beginning of this research:

*H1-a2: The ACT model will have a positive impact on the behavioural engagement of the students after the intervention.*

From the analysis of the data extracted, the hypothesis above is not accepted and is not true. Whereas the ACT model had an impact on certain areas of this behavioural engagement, there is a decrease in the overall engagement after the intervention.

Also, the second research question asked in Chapter 1 is as follows:

*What is the impact of using the ACT model on student behavioural engagement?*

The ACT model has a positive impact on behavioural engagement; however, results show that there was a decrease in the overall engagement of students after using the ACT model. Since

the ACT model emphasises collaboration and holding conversations around content, it does not support students working alone and independently. This may also be the reason why students do not like asking questions in the classroom when they encounter a difficult concept and prefer to rather ask their peers or stay with the task until they find answers and solutions themselves.

To improve the overall behavioural engagement of the students, teachers must give homework that is technology-enabled. Furthermore, rather than ask students to lift their hands to answer questions, teachers can make use of show-me cards that help students indicate their responses without having to lift their hands. Other assessment tools like Plicker cards or Kahoot can also be used to get feedback from students in a more anonymous way. In addition, students can be placed in small groups in the classroom. This helps them discuss content and learn together while also enhancing behavioural engagement.

## **6.5 Impact of the ACT Model on Cognitive Engagement of Respondents**

Cognitive engagement as discussed earlier refers to the tenacity to solve problems, the preference for hard work and a positive attitude towards difficult academic tasks and even failure (Skinner et al., 2007). This section will examine the results presented in Chapter 5 and discuss them in detail, relating to previous literature and answering the research questions.

The results show that there is a general decrease in cognitive engagement of students, after the ACT intervention. While the ACT intervention could have increased students' affective engagement, there was a decrease in the cognitive engagement of the students. Results revealed that there is a 5.2% decrease in the percentage of students who will always try when they find a concept hard. Previous research confirms that whereas it is expected that active learning strategies should naturally increase students' ability to stay on a task cognitively and find answers to difficult concepts, this is not always the case (Hodges, 2020). The results, especially in the face-to-face classroom environment, are usually dependent on the activities and tasks and the way they are designed. It is also dependent on appropriate incentives for participation and group dynamics (Hodges, 2020). Hence, while the ACT pedagogy records a high impact

on the students' cognitive engagement, this engagement is less than pre-intervention engagement.

Additionally, fewer students (40.2%) want to do more work after the ACT intervention as against the 45% during the pre-intervention stage, revealing a decrease in the percentage of students cognitively engaged in learning. Furthermore, students in research by Wu, Veen and Rau (2020) who were prompted to draw outperformed students who did not receive such prompts in cognitive tasks. In another research by El Hammoumi, El Youssfi, El Bachiri and Belaouad (2021), active learning strategies that are teacher-centred produced poor results and did not necessarily make students cognitively engaged. This further confirms that cognitive engagement is highly dependent on the kind of active learning activity being engaged in.

Summarily, the test of difference analysis for cognitive engagement furthermore revealed that there is a decrease from a mean of 23.43 before the intervention to 21.78 after the intervention. This result again shows that the ACT intervention did not have a positive impact on the cognitive engagement of the students. Despite the use of the ACT model, it did not improve students' ability to stay on and try harder on a difficult task nor did students have the capacity to put new knowledge in their own words.

### **What is the impact of using the ACT model on student Cognitive Engagement?**

As stated in Chapter 1, the following research hypothesis on cognitive engagement was postulated at the beginning of this research:

*H1-a3: The ACT model will have a positive impact on the cognitive engagement of the students after the intervention.*

From the data extracted, analysed and results discussed, the hypothesis above is not accepted and true. The results revealed that even though the ACT intervention generally increases student engagement, there was a decrease in the cognitive engagement of the students after the intervention. This may be due to the type of activity performed during the intervention as this is one factor that seriously impacts the effect on cognitive engagement of students.

Also, the third research question asked in Chapter 1 is as follows:

*What is the impact of using the ACT model on student cognitive engagement?*

For this sample of students and teachers, there is a negative impact of the ACT active pedagogy on cognitive engagement of students. The results of this research revealed that the ACT model, due to the type of activities being carried out did not yield an increase in the way students want to learn and how they stay on difficult tasks.

The cognitive engagement of students can be increased if technology-enabled activities are carried out in the classroom. Teachers can engage students in higher-order activities which make them make meaning from complex content. The students, for example, can be required to create an infographic or a video documentary that not only engages them but makes them stay on the task till it is done. Additionally, the concepts of gamification and game-based activities can be introduced to further improve the engagement of the students.

## 6.6 Impact of the ACT Model on Academic Performance of Respondents

The previous chapter revealed the results of the analysis of the academic performance of the students in the four different subjects. Table 6.1 shows a summary of mean tables for all the subjects.

Table 6.1 Summary of percentage means for all subjects before and after the ACT intervention

Subject	Pre Intervention	Post Intervention	Comment
Verbal Reasoning	75.77%	70.3%	Decrease
French	67.84%	67.41%	Slight decrease
Mathematics	56.15%	64.94%	Significant increase
Computer Studies	75.2%	76.48%	Increase
<b>Average Mean</b>	<b>68.74%</b>	<b>69.78%</b>	<b>Increase</b>

From table 6.1 shown and as stated in Chapter 5, after the intervention, there is a slight decrease in the percentage mean in verbal reasoning and French. This is probably because the verbal

reasoning teacher had previously undergone training on the ACT pedagogy and had been teaching using the model before the research was carried out.

However, there was a significant increase in the percentage mean in both mathematics and computer studies. Additionally, there is an overall increase in the mean as shown in the average mean of the subjects and a significant p-value of 0.001. This means that the ACT active pedagogy positively influenced the academic performance of the students.

This is consistent with the research by Roberts (2019) that revealed that students perform better when they are taught using active approaches. One student said “My grades went up as soon as I began to learn with educational games. I was not only engaged, I actually performed better” (Plump et al., 2017). Another research showed that 89% of the 120 students in Moroccan universities preferred self-directed, active learning. This increased their academic performance (El Hammoumi et al., 2021).

It is very worth noting that there is a significant increase in the percentage mean of mathematics from 56.15% pre-intervention to 64.94% after the intervention. This means there is an increase of 8.79% in the percentage mean of the performance of students in Mathematics. Whereas, Mathematics appears to be a difficult subject for many students, the use of the ACT pedagogy can bring a better understanding to students and thereby help improve their performance.

### **What is the impact of using the ACT model on student Academic Performance?**

As stated in Chapter 1, the following research hypothesis on cognitive engagement was postulated at the beginning of this research:

*H1-a4: The ACT model will have a positive impact on the academic performance of the students after the intervention.*

The analysis of the results revealed that the ACT model had a positive impact on the academic performance of the students, hence, the hypothesis is accepted to be true and valid. When teachers teach using the ACT active pedagogy, it will impact positively their performance.

Also, the fourth research question asked in Chapter 1 is as follows:

*What is the impact of using the ACT model on student academic performance?*

As revealed by the results of the research, there is a positive impact of the ACT model on the academic performance of students. Active pedagogies when used appropriately, help students understand concepts better and recall what was taught. The pedagogy of correction which encourages students to try harder and fail better until they master the content, helps students work through concepts in such a way as to perform well. The pedagogy of creation as well encourages students to create an artefact from their understanding of a concept. This ensures that the student properly understands the concept, and can create something that shows that understanding.

## **6.7 Pre-intervention experience themes**

This research was carried out to find out the impact of the Activated Classroom Teaching active pedagogy on student engagement and academic performance. To achieve this, a mixed-method approach was utilized. First, quantitative data was collected with the use of a questionnaire to find out what impact the active pedagogy would have on student engagement. Next, teacher-made tests were administered and compared with tests administered before the ACT intervention. This data has been analysed and discussed in previous sections of this thesis.

However, to supplement the quantitative discussion, qualitative data in the form of a focus group discussion (FGD) was also secured. As stated in Chapter 5, the interview was transcribed, and coded and themes have been drawn from the different codes. These codes and themes have been drawn into a code tree. A code tree as shown in Figure 5.1 is a figure showing how the codes were formed from various sections of the text and how themes were drawn from the codes. This section will discuss the codes and especially the themes arising from the pre-intervention phase. Below are the codes under the major themes:

### **1. Challenges with teaching methods**

- Boring method of teaching
- No feedback from students

- The assessment was stereotyped and boring
- The teacher is tired out

## **2. Challenges with students' engagement**

- Produced passive students
- Chorus answer to questions
- The teacher is in control of the class

## **3. Challenges with students' creativity and learning**

- Ignored the creativity of students
- Limit students' thinking
- Limit students' learning
- Struggle with certain challenging concepts

### ***6.7.1 Challenges with teaching methods***

One of the central themes that evolved from the discussion with the teachers during the FGD concerning the pre-intervention phase is the challenge with teaching methods. Several teachers especially those going through the conventional teacher training programs, have been trained to teach conventionally. Kumar (2018) wrote about the “Chalk-and-Talk” way of teaching, which sees the teacher take a central place in the instruction and talk throughout the entire time. According to him, whereas teachers in Chinese schools still favour this kind of teaching, teachers in UK and US are moving away from such teacher-centred approaches to those that engage the students (Kumar, 2018). Several researchers have researched the various teaching methods that can be applied to teaching and learning. According to Westwood (2008), teaching methods can be placed into three (3) different categories namely: teacher-centred, student-centred and content-focused. These approaches differ in the way they are employed and in the results achieved.

The teacher-centred approaches put the teacher or instructor at the centre of teaching and learning and as the master who holds all the knowledge. This includes all direct instruction approaches, lecture methods etc. where the students sit arranged in rows, without permission to talk and the teacher stands in front of the class dishing out the instruction. This approach which does not take into consideration the participation of students makes students disengaged and makes learning boring. Students have to keep quiet, do nothing and consume content the entire time.

This is a recurrent theme during the pre-intervention phase of this research as teachers taught using disengaged methods and approaches. One teacher said, “I was just the one dominating the class anyway (and) not having any feedback from them (the students)” (Participant 2). There was no way to know what the students were learning or not learning, until at the stipulated, organized assessment times. Of course, this made assessments also to be stereotyped and boring and made students develop anxiety towards assessments. Bryant and Carless (2010) discussed a test-dominated environment and the effect it had on students. The students commented that they became bored undergoing the same routine tests every week. Furthermore, this teaching approach has led to teachers being tired out, as identified in the discussion. According to Farber (2000), there are a few factors that cause teacher burnout and one of them is the excessive desire to hold control and be in charge of the teaching process. The inability to allow student choice and encourage student participation, causes teachers to get tired out. Teachers must teach in such a way that it is student-centred and the students are allowed some choices. Teachers must give students tasks and activities to perform that make them active and engaged in the classroom.

### ***6.7.2 Challenges with Students’ Engagement***

The second main theme that evolved from the discussion during the pre-intervention phase is the challenges that have to do with student engagement. As a result of the teaching approach employed by teachers, students are usually not engaged in the classroom. As decoded in the discussions, students are rather passive than active and involved in the learning process. According to Russell (2021), passive learning is when all the content is generated by the teacher

and the students simply take in and absorb the information, without engaging in it at some level. Listening continuously, taking notes and keeping quiet the entire time in a class can be a great challenge for 21<sup>st</sup>-century learners and affect their cognitive engagement. Hitherto, students are used to learning in this passive way. They have not been trained to engage in the content and discuss their findings or learnings nor are they trained to create their own learning. This passive approach to teaching and learning poses a challenge to student engagement. According to Sherrington (2023), students are passive, repeatedly saying “I don’t know” and they’re unwilling to participate due to several reasons. One could be that they are genuinely ignorant of the concept or topic. Also, some students are simply anxious and afraid to participate in class for fear of not getting it right while some have just built a habit of passivity and need a push. Sherrington (2023) suggested that teachers can give scaffolded or minimal choices to help students feel a bit confident in responding to class activities; this can avoid the “I don’t know” reply.

Furthermore, disengaged students are characterized by their unwillingness to respond as an individual to questions asked in class. As discussed by the teachers during the FGD, students would rather prefer to give chorus answers to questions to hide under the cover of those who actually know the answer. Unsuspecting teachers can assume that all students are fully engaged in the class simply because they have given a chorus answer to a question until each learner is asked to show individual evidence of learning. According to Gray (2013), the “show-me-your-board” strategy which involves students lifting individual cards to quickly show what they are learning can encourage ordinarily passive and disengaged students. Another technique that can be used to engage students in the classroom in place of chorus answers is the use of Plickers cards, which can be used to get individual student voices. Plickers is a simple tool used to collect quick formative assessments from students (Krause, O'Neil, & Dauenhauer, 2017). While the ‘show-me-your-board’ cards allow for students to write on the cards, the Plickers cards allow students to choose between 4 options only – A, B, C and D; so only multiple-choice assessment questions can be asked. However, this technique also solves the challenge of student engagement in the classroom. The picture in Figure 6.1 below shows a teacher taking a formative assessment using the Plickers cards.



*Figure 6.1 A picture of a teacher taking an assessment using Plickers cards*

### ***6.7.3 Challenges with Students' Creativity and Learning***

This is the third major theme that evolved from the analysis of the group discussion with the teachers. During the pre-intervention phase, there is a challenge relating to students' creativity and learning. Due to the fact that students are passive and disengaged in the classroom, the inborn creativity of students is not allowed to blossom. Every child is born with an inquisitiveness and creativity (Pande et al., 2020), that fuels the child's desire to learn. Unfortunately, the passive, teacher-centred approach to teaching that was employed before the intervention made it difficult for the creativity of the students to be nurtured. They simply cram in the limited information given to them by the teacher and are not allowed to think outside the box. According to Anderson et al. (2001), the kind of assessments given and the way they are graded limit the creativity of the students. When students are asked direct theoretical questions

that only require recall of facts and statements, then they are not encouraged to be creative in their learning. This is heightened by some teachers who mark wrong any answers given which is not exactly as it was written in the note. This limits the students' thinking and ability to create their learning.

For example, in a creative arts class, where students are told what to draw, how to draw and which way to draw all of the time, the creativity of the students is hampered (Roberts, 2019). Teachers must release certain choices to the students so they can bring out what is in them. Unless the students are allowed to be creative, they will be very limited in their learning. Calder et al. (2018) mentioned in their research how he uses group-solving techniques in their mathematics class. Rather than he, as the teacher, always doing the teaching, the students are placed in solving groups to brainstorm on the problem and solve it together. This not only increases the students' engagement but also increases their ability to think and thereby increases the actual learning that is taking place.

This passive approach to teaching has also made it difficult for students to understand certain challenging concepts. According to Hassan et al. (2015), a student's ability to understand difficult concepts is dependent on many factors. However, when students are not allowed to be involved in their learning and be creative in their approach, they only become passive and disengaged in the classroom. This eventually leads to a lack of understanding of the concept, which then reflects in their academic performance.

#### ***6.7.4 The Challenge of a boring class***

This can be seen as the summary of the pre-intervention phase, as revealed by the word cloud generated from the words from the group discussion held with teachers. This word cloud, as shown in Figure 5.3, reveals the main words boring and class. This is not far-fetched. Once a class is plagued by a passive teaching approach, it will lead to passive and disengaged students. This will eventually affect the creativity of the students and their ability to learn, especially when it comes to difficult concepts.

Once all of these happen, eventually the class will be termed as boring. In essence, a boring class is one where the teacher is at the centre of the teaching and learning and the students are

passive, not allowed to talk and not engaged in the learning process. Just as teachers do not like boring meetings, so also students do not enjoy boring classes (Bryant et al., 2010). However, unfortunately, they are getting used to passive, disengaged and boring classes, which makes schooling uninteresting to many students (Bryant et al., 2010). In another research, students lament about how they hate to go to boring classes because, in such classes, they are not allowed to express themselves (Todd, 2020). One student mentioned how much the content being taught by the teacher was ‘out of date’ but since he would not involve them, they just quietly made fun of the teacher’s ignorance. This is heightened if the class is an online class. The inability of the teacher and students to maintain real eye contact and have physical interaction in an online learning environment can easily encourage a boring class.

This research, therefore, helped to see what impact teaching with an active pedagogical approach will have on student engagement and academic performance, and how it can eradicate boring classes. This means teachers either in face-to-face or online teaching must make deliberate efforts to make the class an active one and engage the students with different activities which make them involved in the learning process. Rather than retain control and choice, teachers can release it so students’ creativity can be released.

## **6.8 Intervention phase experience themes**

The previous section discussed the major themes that evolved from the analysis of the focus group discussion with the teachers, as regards the pre-intervention phase. We considered the various challenges that students faced before the ACT active pedagogy was introduced during the research. This section, however, will examine the major themes that evolved from the analysis, with a focus on the post-intervention phase. The following sub-sections will discuss each of the major themes and link them to past literature. As a way of reminder, the following are the codes derived from the analysis under the major themes:

### **1. Engaging teaching methods**

- Broaden content
- Increased discussion in class

- Learning is fun and interesting
- Make learning practical

## **2. Benefits of active learning**

- Students are active while learning in and out of class
- Students are able to think
- Increased student expression
- Finding each student's voice

## **3. Improved learning outcomes**

- Increased recall of content
- Eagerness to learn
- Understanding of concepts

### ***6.8.1 Engaging teaching methods***

The first major theme that was derived from the codes was the appropriate use of teaching methods in such a way that it is engaging. The introduction of the Activated Classroom Teaching (ACT) active pedagogy during the research introduced an active approach to teaching and learning. This helped to broaden the scope of the content presented to the students, beyond the textbook and even the specific curriculum. During the discussion, one teacher said “Before the intervention, my students and I didn’t know why certain ingredients were necessary for a particular procedure. However, with the active learning approach, we not only know why they are useful, but we also know what they’re used for and in what quantity they should be used” (Participant 4). Active teaching methods like blended learning or flipped learning help to broaden the content beyond what can be taught in the classroom. According to Merkt et al. (2011), students can read wider and gain a further understanding of concepts either outside the classroom or in the classroom. When students are allowed to watch videos at home and come

to class to discuss their understanding in groups, this broadens the content and increases understanding. Additionally, this increases the discussion that goes on in the classroom (Merkt et al., 2011). Students can be placed in groups to discuss the content or brainstorm an idea together before presenting it to the entire class (Roehl et al., 2013).

This itself makes learning fun and practical. Whereas students are used to sitting quietly in class and thus become bored, active learning makes learning fun, interesting and practical. Students can play educational games that help them learn difficult concepts while experiencing the fun. According to a parent, her child who previously disliked home-assigned tasks now wants to go to school and do all home-assigned tasks as long as it is via a game app (Apostol et al., 2013). According to the child, “It is fun because I want to finish all the levels even before my friends”. Apps like Kahoot (Plump et al., 2017) which allows students to learn in a fun and interesting way make students engaged in the classroom, as they answer questions prepared by their teachers. Furthermore, according to one of the teachers in this research, the students enjoyed working with their hands as part of the learning. Even when they didn’t all have the necessary items for the practical class, the students will get involved using practical items that belong to their friends and even find a way to carry out the practical work even outside the classroom.

### ***6.8.2 Benefits of active learning***

This is the second major theme derived from the codes after the analysis of the group discussion with the teachers, during the intervention stage. The ACT pedagogy gave rise to active learning in the classroom. According to Carr et al. (2015), active learning happens when the students are fully involved in the tasks and activities that make them learn and the teachers are simply guiding that process. Active learning is what happens when students are not kept under the ‘control’ of the teacher but are released to take control of their learning, deciding what and especially how the learning must take place.

The ACT active pedagogy helped to achieve active learning, as the students participated greatly in the learning in and out of the classroom. This was easily seen by the increased student expressions in the classroom. During the research, the erstwhile disengaged students who

would not answer any questions, are seen expressing themselves by asking and answering questions in the classroom. Students now have the opportunity to interact with their peers and with the teacher around the content. Research by Carr et al. (2015) mentioned how students' interactions increased, thereby increasing the understanding and retention rate of the students simply because of the active approaches employed in the classroom. This was corroborated by the research conducted by Blewett (2016b) where students interacted with themselves as they make use of the affordances of technology to enhance their learning, thereby improving the performance of students.

Furthermore, the research showed an increase in students' voices in the classroom as a result of the ACT pedagogy used in teaching. One teacher said during the group discussion that he noticed a few students who would never speak in the class previously begin to speak and respond. This means that using an active pedagogy not only improves student-to-student interaction but increases the confidence of students and gives each one a voice in the classroom. As reported by Sherrington (2023), even students who would not find space to talk because of the very active ones, have been given a voice when they have to respond using technology in the classroom. As noted previously, simple active teaching methods like the show-me-your-board cards give each student a unique voice, where the teacher can see exactly what each student knows (Duchaine, Green, & Jolivette, 2011).

### ***6.8.3 Improved learning outcomes***

The final theme derived from the focus group discussion with the teachers in this research is improved learning outcomes. This is a major result of the analysis of the group discussion held with the teachers and it is the natural result of the first two themes. Once teachers teach using methods that are engaging and interesting, it will result in active learning. Students will become interested in learning and will interact in the classroom, taking control of their learning themselves. The eventual result is an improvement in the learning outcomes. These students will recall more content taught. 72% of the students in Roehl et al. (2013) research found it easier to recall what was taught when they were involved in it and active while learning it. One student reported that he would remember more of what was taught because he was engaged in

the classroom. He said he would always remember the context where the learning took place, the activity and the things that happened around the learning (Hodges, 2020). This is also in line with the research by Merugu et al. (2023) that discovered that more students performed better because of the use of active technologies during the teaching and learning process.

This begins with an increase in the understanding of the concepts being taught. Active learning strategies like the ACT model, consider the individual strengths of the students and attempt to cater for them while teaching. As discussed above, active teaching encourages students' voices and makes sure every student understands personally what is being taught, not just answering in a chorus way in the classroom. While teaching with the ACT active pedagogy, it is not strange to see students' faces brighten with excitement as they suddenly understand a particular concept, maybe after watching a video or discussing a concept with their peers in groups. According to Mischel (2019), one way to improve the understanding of difficult topics and concepts is to make students part of the teaching. One teacher always asks her students to publicly take turns explaining different aspects of a process after watching a video together. She found that this approach that engages the students in the classroom also increased their understanding of those concepts (Mischel, 2019). The students were able to work on their own, recall what was done and eventually performed well academically. This made the students also eager to learn at other times. The understanding of a concept is necessary for students to desire to learn again, especially in such a subject. Ribosa et al. (2022) also iterated that students become more eager to learn and confident to work when they fully understand previous concepts taught. This is achievable when active pedagogies are used to teach.

## **6.9 Class taught with technology and guided by pedagogy**

A critical look at the word cloud generated from the post-intervention section of the text of the focus group discussion held with the teachers revealed that one of the successes of the research on the ACT model is that the classes were taught with technology and it was guided by a suitable pedagogy. These two components account for the greatest impact of the ACT active pedagogy on student learning and academic performance.

### ***6.9.1 A class taught by technology***

One of the characteristics of the 21<sup>st</sup>-century classroom is that teachers are trained to teach effectively using technology and students are also trained to learn effectively using technology. Whereas the traditional classroom is teacher-centred and does not involve the students in the learning process, there are other attempts to introduce active learning into the classroom without the use of technology. Strategies like the “show-me-your-board” cards are good but do not make use of technology. Other active strategies like having students discuss in groups and make verbal presentations in the classroom may also make students engaged in the classroom but do not take into consideration the technology age in which we currently are (Churches, 2008).

The ACT model, therefore, not only introduces activities that make students active but also makes use of the affordances of technology to achieve this. Teachers must be adequately trained to teach effectively with technology, rather than become afraid of using it in the classroom (Beichner, 2014). The increasing number of education technology tools makes teaching with technology easier to accomplish, as 21<sup>st</sup>-century students are termed digital natives and already are familiar with these technology tools (Ribosa et al., 2022). They do not need any training on how to use these tools, even though they may need to be trained on how to maximize them for learning purposes.

Therefore, teachers who would see an improvement in the engagement and performance of their students must consider a technology-enabled classroom. Teachers must seek continuous training on how best to teach effectively, using the various technology tools available for teaching and learning. They must engage their students with technology-enabled tasks and activities, that will train the students to not only learn to use the technology but set them on a lifelong journey of learning on their own, using available technology tools. This will also have the added advantage of teaching soft skills and technical skills that will be useful when they begin to work.

### ***6.9.2 Teaching Guided by Pedagogy***

However, the biggest advantage of the ACT active pedagogy is that it provides a technology-enabled approach or method to teaching and learning. Whereas there could be several classrooms where technology is being used, not many are being guided by a specific pedagogy. This research examined the ACT pedagogy as an active model that can guide the use of technology in the classroom. The ACT pedagogy not only introduces technology tools that can be used for teaching but also provides a systematic guide to teaching effectively with those technology tools. One mistake that many 21<sup>st</sup>-century teachers make is the eagerness to use technology in the classroom without following an appropriate guide (Hew et al., 2020). This is why several technology attempts in the classroom have failed (Blewett, 2016a) and it appears as though technology has no place in the classroom.

One of the impacts of the ACT active pedagogy is the introduction and running of classrooms where teachers are trained to teach effectively with technology, following a clearly laid out pedagogy and achieving student engagement and an improvement in academic performance. As seen previously, the model introduces activities from curation to conversation, to correction, creation and chaos (Blewett, 2016a). So even though teachers can use PowerPoint in the classroom, if it is not used being guided by a pedagogy, it would not yield the expected result. This is the reason a student complained about how he did not enjoy a class and how the technology was rather a distraction than a help (Hew et al., 2020). Technology use in the classroom without an appropriate pedagogy, known both to the teachers and the students would still not produce the student engagement that is desired.

## **6.10 Impact of the ACT Model on student learning**

The focus of this research has been to investigate the impact of using an active pedagogic approach to teaching with technology on student learning. This research applied a mixed methods approach, using both quantitative and qualitative data to establish the facts. This has helped us to answer the different research questions the researcher started out to answer. This section, also, will answer the final research question and discuss the issues surrounding the impact of the ACT model on student learning.

The final research question for this research is: *How does the ACT model enhance student learning?*

In this research, student learning was measured using the different student engagement constructs and academic performance and the impact of the ACT model on these two parameters has been discussed in detail in previous sections of this chapter. This section will simply bring together all that has been previously discussed and examine how the ACT model enhances student learning.

When the ACT model is properly employed in teaching and learning, it has a positive impact on the engagement of students. According to this research, it was discovered that students' liking for the subject, liking for the teacher and liking for their school increased due to the introduction of the ACT model. Students always looked forward to having a class session rather than hiding away from it. They sought every opportunity and requested that every free space be used by the teacher to teach them. This shows that they liked the subject and this made them like the teacher as well. Students love playing games and when games were introduced in the process of learning in the classroom, students loved the subject and teacher more.

Furthermore, the ACT model increased students' participation and persistence in the classroom. For example, when a teacher engages the pedagogy of conversation and breaks his students into different groups, where they can study, discuss and present a paper on a topic, this engages the students and increases participation. Every student would be required to be a part of the group, contribute his part and see to the overall success of the group. In another case, a teacher who engages the assessment tool of Plickers also gets every student to participate in the learning process, and this increases their attention and efforts because no student wants to be seen as not getting the right answer. Therefore, students have been seen to learn more when taught using the ACT pedagogy.

Additionally, the research has revealed that when used properly, the ACT model further engages students cognitively. The pedagogy of chaos for example can be used to task students with designing an infographic that distils the major points of learning. This activity tasks the minds of the students and encourages them to think deeply about what they learnt and be able to create a visual representation of it. The pedagogy of correction in the ACT model also helps

students think about trying harder and getting better. This improves student learning as students can stay on a task trying to figure out what went wrong and how to correct it or make it better. Consequently, the ACT model increased the academic performance of the students. The more engaged the students were with the learning process, the better they performed in their academics. The more cognitively engaged the students were, the more they understood the concepts being taught and so the better they performed academically. The ACT model, therefore, made the students more confident of what they were learning and so they performed better academically.

Summarily, it has been seen that the ACT model enhances the learning of students. When teaching and learning are approached from an active pedagogical approach, guided by a suitable model like the Activated Classroom Teaching (ACT) model, the results can be outstanding. Students are more engaged and perform better academically, hence they learn more with the proper application of the ACT active pedagogy.

## **6.11 Summary**

This section has considered and discussed in detail the findings from the research. The impact of the ACT model on the different student engagement constructs has been discussed. The impact of the ACT model on the academic performance of the students has also been discussed. The major themes derived from the focus group discussion with the teachers, both during the pre-intervention and the post-intervention stages have been analysed and discussed in this chapter. Furthermore, the hypothesis postulated and the various research questions asked at the beginning of the research have been addressed and answered extensively.

The next and final chapter will conclude the entire thesis and discuss opportunities for further research in this field.

## **CHAPTER 7**

### **CONCLUSION AND FURTHER RESEARCH**

#### **7.1 Introduction**

Education has gone through several phases and the advent of technology has made teaching and learning take a different form in recent years. However, there have been successes and failures with technology use and integration in the classroom. Whereas in some cases, technology has impacted the ability to learn positively; in other reported cases, the opposite has been the case. One major reason for this difference in results is the use or not of a suitable pedagogy for learning.

This research, therefore, set out to investigate the impact the use of an active pedagogic approach to teaching with technology will have on student learning. The research investigated what impact the Activated Classroom Teaching pedagogy had on student engagement and academic performance, as parameters for measuring student learning.

Having analysed the results, discussed the findings and answered the research questions in previous chapters, this final chapter will summarise and conclude the study and the thesis. In this chapter, a summary of the research and the major findings will be presented and recommendations will be made. Also, the limitations of the study and further research directions will be suggested.

#### **7.2 Research Summary and Key Findings**

The research aimed at investigating the impact of using an active pedagogic approach to teaching with technology on student learning. This section presents a summary of the research and the major findings from this research.

This thesis is presented in seven chapters. Chapter one provides an overview of the research and discloses the need and problem to be solved. The conflicting results of successes and failures in the use of technology in teaching and learning pose a problem to be solved. The

ACT pedagogy, an active pedagogic approach that uses technology to teach was investigated and its impact on student learning was discovered. Chapter one also discussed the research objectives, as well as the questions which this research aimed to answer.

Chapter two presented a detailed review of relevant literature. Concepts revolving around learning, passive and active uses of technology and technology-enabled active learning strategies were discussed thoroughly. The impact of the COVID-19 pandemic on e-learning was considered alongside the 4<sup>th</sup> and 5<sup>th</sup> industrial revolutions. As seen in the literature, Education 5.0 goes beyond using technology apps, running online classes and having distance learning, it trains students to turn digital transformation into a tool for social transformation. Finally, the recent explosion of Artificial intelligence and its impact on teaching and learning was also discussed.

Chapter three introduced the Activated Classroom Teaching (ACT) model which is the active pedagogy under exploration. The six layers of the ACT active pedagogy namely consumption, curation, conversation, correction, creation and chaos were examined and discussed. Furthermore, it was established that student learning is measured by a combination of student engagement and academic performance. According to research, three constructs are used to measure student engagement which are affective, behavioural and cognitive and these three were examined in detail. At the end of the chapter, a conceptual framework was designed to merge the ACT model and Student learning concepts; which guided the formulation of the questionnaire and became the basis of the data collection procedures.

Chapter four presented the research methodology, data collection and analysis procedures adopted. For this research, purposive sampling under non-probability sampling techniques was adopted because the participants were chosen based on certain characteristics. A mixed-method approach was adopted for this research. Quantitative data was collected using a questionnaire and supported by qualitative data from focus group discussions. The questionnaire was designed to cater for how the ACT intervention impacted the different student engagement constructs. This questionnaire was administered both before and after the intervention and compared to see what impact was made by the intervention. Secondary data from previous tests and post-intervention teacher-made tests administered, were other forms of data collected.

Finally, a focus group discussion was held with the four teachers who participated in the research to gain further insights into the topic under consideration and the data gotten were analysed. Different data analysis methods were used to carry out both quantitative and qualitative analyses of the data extracted from the instruments. At the end of the chapter, ethical considerations were outlined.

In chapter five, the initial interpretation and analysis of results were presented. This began with the demographic characteristics and went ahead to discuss the results of the student engagement and academic performance of the students. The impact of the ACT active pedagogy intervention on affective, behavioural and cognitive engagement was discussed as well as the impact of the intervention on the academic performance of the participants in verbal reasoning, mathematics, french and computer studies. In this chapter, the qualitative data gotten from the focus group discussion was also analysed using a code tree and word cloud. The FGD had questions based on two main areas - what the experience of teaching and learning was like before the intervention and what it was like during the intervention. A total of twenty-two (22) codes and six (6) themes were derived from the analysis, and presented in this chapter.

Chapter six then dived further into the discussion of these findings. The impacts of the ACT model on affective, behavioural and cognitive engagement were further discussed. Here it was seen that there is a significant improvement in the students' affective engagement after the ACT intervention. Additionally, the ACT model had a positive impact on the behavioural engagement of students; however, results showed that there was a decrease in the overall behavioural engagement of students after using the ACT model. Finally, the results of this research revealed that the ACT model, due to the type of activities being carried out didn't yield an increase in the way students want to learn and how they stay on difficult tasks, cognitively.

However, as revealed by the results of the research, there is a positive impact of the ACT model on the academic performance of students. Active pedagogies when used appropriately, help students understand concepts better, recall what was taught and perform better in their academics. Furthermore, this chapter discussed the six major themes drawn from the code tree and the two main concepts discovered from the word cloud. The research questions were

answered in this chapter and the various hypotheses were responded to. At the end of the chapter, the impact of the ACT model on student engagement was discussed as well.

As a way of summary, the research has revealed that the use of an active pedagogic approach to teaching and learning will have a positive impact on student learning. Simply using technology in the classroom without being guided by an active pedagogy will not produce the desired result. Teachers must be trained to teach effectively with technology and with appropriate teaching methods, that will engage students and increase their performance. Modern technology like artificial intelligence can be explored to improve the way we teach and learn in the classroom.

### **7.3 Recommendations and Implications**

The research highlights certain implications that can help build on the success of teaching and learning, to increase student engagement and the academic performance of students. This section will present a few recommendations based on the results of this research.

#### ***7.3.1 The use of an active pedagogy in teaching and learning***

Based on the findings and insights gathered from the research, the major recommendation that emerges is the use of an active pedagogy in teaching and learning. In order to achieve the desired outcomes and maximize the potential of technology in education, teachers must recognize that the mere use of technology tools and devices is not sufficient. Simply integrating technology into the classroom without a thoughtful and purposeful active pedagogy may not lead to the desired increase in student engagement and academic performance. Therefore, it is recommended that teachers adopt appropriate active pedagogies that guide teaching and learning in conjunction with the use of technology and that students are aware of this pedagogy so they can understand why they have to learn in the way that they will be required to learn.

An active pedagogy ensures that teachers approach technology integration deliberately and intentionally, rather than relying on a trial-and-error approach. By employing an active pedagogy, teachers can effectively leverage technology in their instructional practices,

activities, and assessments. This pedagogical approach not only enhances student understanding but also fosters critical thinking, collaboration, and problem-solving skills. It empowers students to become active participants in their learning process and prepares them for the challenges of the future.

As seen in this research, one specific active pedagogy that is highly recommended for teaching with technology is the Activated Classroom Teaching (ACT) model. This model is specifically designed to integrate technology seamlessly into the teaching and learning process. The various layers of the ACT model, such as consumption, curation, conversation, correction, creation, and chaos, provide different levels of student engagement and involvement. Each layer introduces students to new technologies and encourages the development of essential digital literacy skills.

By utilizing the ACT model, teachers can move beyond passive consumption of information to activities that promote active engagement and creation. Students are encouraged to curate and organize information, engage in meaningful conversations, provide and receive feedback, and ultimately create their own content. This active pedagogy not only enhances student comprehension of complex concepts but also equips them with the skills necessary to thrive in a rapidly evolving digital landscape.

In conclusion, it is imperative for teachers to recognize that the effective integration of technology in education requires more than the mere presence of technology tools and devices. Teachers should adopt an active pedagogy that aligns with the use of technology and encourages student engagement, critical thinking, and collaboration. The ACT model, specifically designed for teaching with technology, offers a comprehensive framework that promotes student-centred learning and prepares students for the demands of the future. By combining appropriate technology tools with an active pedagogy, teachers can create a dynamic and enriching learning environment that enhances student understanding, engagement, and academic performance.

### *7.3.2 Release of Control and Choice of learning*

Based on the findings and insights gathered from the research, a compelling recommendation emerges regarding the release of control and the incorporation of choice in the learning process. It is recommended that teachers adopt an instructional approach that involves releasing the strict control traditionally exerted over the classroom and activities, and instead empower students to take charge of their own learning experiences. By providing students with opportunities to determine certain aspects of their learning, such as topic selection and presentation format, teachers can foster a more engaging and student-centred learning environment.

To implement this recommendation effectively, teachers should recognise the importance of student autonomy in the learning process and actively promote it within the classroom. This can be achieved by offering students choices in various aspects of their learning, such as selecting topics of interest or choosing from a range of presentation formats. By granting students the freedom to make decisions and take ownership of their learning, teachers can enhance student engagement and motivation.

Nevertheless, while releasing control, it is crucial for teachers to provide clear guidelines and support to ensure that students make informed choices and stay on track. Teachers should establish parameters within which students can exercise their choices, providing frameworks and resources to assist them in making meaningful decisions. This support will help students navigate the learning process effectively and ensure that their choices align with the learning objectives.

Additionally, to optimise the benefits of releasing control and choice, teachers should foster a collaborative and inclusive classroom environment. Encouraging students to share their chosen topics or presentation formats with their peers can promote peer learning and allow for diverse perspectives. Teachers should also create opportunities for students to collaborate on group projects or engage in peer feedback, further enhancing their learning experiences.

The implementation of these recommendations is expected to yield several positive outcomes. By releasing control and allowing students to determine certain aspects of their learning, teachers are likely to observe increased student engagement, as students become active

participants in their education. Furthermore, students are more likely to develop a sense of ownership and responsibility for their learning outcomes, leading to improved academic performance.

It is important to acknowledge that the release of control and choice of learning may require a shift in traditional teaching practices and necessitate ongoing reflection, adaptation and training by teachers. Professional development opportunities and supportive administrative policies should be provided to facilitate this transition.

In conclusion, the recommendation to release control and incorporate student choice in the learning process has the potential to transform the classroom into a dynamic and student-centred environment. By embracing student autonomy, providing structured support, and fostering collaboration, teachers can empower students to take charge of their learning and enhance their academic performance. This paradigm shift towards student-centred learning holds promise for creating meaningful and engaging educational experiences that promote lifelong learning.

### ***7.3.3 Allow for the creation of an artefact***

To foster a more engaging and effective learning environment, it is recommended that teachers embrace the practice of allowing and encouraging students to become creators of content rather than solely consumers. By providing students with opportunities to create artefacts such as infographics, audio recordings, animations, cartoons, videos, and text flows, teachers can tap into students' innate creativity and enable them to demonstrate their knowledge and understanding in meaningful, expressive and unique ways.

When students are given the freedom and agency to create, they are motivated to engage deeply with the subject matter. The process of creating requires a solid grasp of the underlying concepts, as students must synthesise and apply their knowledge to effectively convey their ideas through their chosen medium. By engaging in the creation process, students are not only demonstrating their understanding, but they are also solidifying their knowledge and developing important skills that are crucial for their future success.

Additionally, creating artefacts in the classroom allows students to take ownership of their learning. It encourages them to think critically, solve problems, make connections, and express their unique perspectives. By actively participating in the creation process, students become more invested in their learning, leading to increased motivation, engagement, and academic performance.

Moreover, the act of creating artefacts promotes the development of essential 21st-century skills such as creativity, communication, collaboration, and digital literacy. These skills are highly valued in today's rapidly evolving society, and by incorporating opportunities for artefact creation into the curriculum, teachers can help prepare students for the challenges and opportunities they will encounter in the future.

In conclusion, it is recommended that teachers shift their pedagogical approach from the passive consumption of information to the active creation of artefacts by students. By providing students with opportunities to create content using various media, teachers can foster a more engaging and student-centred learning environment. This approach not only allows students to showcase their knowledge and understanding, but also enhances their critical thinking, problem-solving, and digital literacy skills. By encouraging the creation of artefacts, teachers empower students to become active participants in their learning journey, leading to increased academic performance and a deeper appreciation for the subject matter.

#### ***7.3.4 Adoption of AI in teaching and learning***

In the era of Education 5.0, characterised by the integration of Artificial Intelligence (AI) into education, educators must embrace the potential of AI and explore its applications in teaching and learning. Rather than imposing restrictions or prohibitions on AI technologies, it is recommended that teachers proactively seek ways to leverage AI to enhance their instructional practices and improve student engagement and academic performance.

AI can greatly benefit teachers by streamlining their work processes and saving time. For instance, AI chatbots and tools like ChatGPT ([chat.openai.com](https://chat.openai.com)), Google Bard ([bard.google.com](https://bard.google.com)), and Bing ([bing.com/ai](https://bing.com/ai)) can assist teachers in setting high-quality assessment questions. These AI-powered tools can generate well-crafted questions that

effectively assess students' knowledge and understanding. By utilizing AI in this manner, teachers can devote more time to instructional planning and personalized support for students, leading to increased student engagement and improved academic outcomes.

Furthermore, AI can empower students to become more effective learners. AI algorithms can provide students with prompts and suggestions to enhance their writing skills, leading to improved written expression and communication abilities. Additionally, AI technology can facilitate more efficient and targeted research by delivering accurate and relevant search results. This empowers students to access a wealth of information and develop critical thinking skills, ultimately enhancing their academic performance.

Incorporating AI into the teaching and learning process has the potential to revolutionise education by offering personalized and adaptive learning experiences. AI-powered educational platforms can analyse students' individual learning patterns, preferences, and performance data to tailor instructional content and activities to their specific needs. This level of personalisation fosters student engagement, as learners are actively involved in their learning journeys, and increases academic performance by addressing students' unique strengths and areas for improvement.

However, it is important to maintain a balanced approach to the adoption of AI in education. While AI technologies can provide valuable support, they should never replace the role of the teacher. Human interaction, guidance, and mentorship remain essential components of effective teaching and learning. Teachers should view AI as a tool to enhance their pedagogical practices and create dynamic learning environments that promote collaboration, critical thinking, and creativity.

In conclusion, the adoption of AI in teaching and learning has the potential to significantly transform education. By embracing AI technologies and leveraging their capabilities in areas such as assessment, writing support, and research assistance, teachers can enhance student engagement and academic performance. It is crucial for educators to proactively explore and integrate AI into their instructional practices, ensuring that students are equipped with the skills and knowledge required to thrive in the digital age.

### ***7.3.5 Training of teachers to teach effectively with technology***

The effective integration of technology in teaching and learning requires a well-trained and skilled teaching workforce. It is not enough for teachers to possess basic technological literacy; they must also undergo continuous professional development and training to effectively leverage technology in the classroom. Therefore, it is recommended that teachers receive comprehensive formal and informal training to maximize the use of technology and, more importantly, teach effectively with technology, leading to increased student engagement and improved academic performance.

Firstly, teachers need to receive training that goes beyond mere familiarity with technology tools. Teachers should be equipped with the necessary pedagogical knowledge and instructional strategies to integrate technology seamlessly into their teaching practices. This includes understanding how to align technology with curriculum goals, designing technology-enhanced learning activities, and effectively assessing student learning in a technology-rich environment. Formal training programs, workshops, and courses focused on technology integration should be made available to teachers, enabling them to acquire the skills and competencies needed to create engaging and effective learning experiences for their students.

In addition to formal training, teachers can benefit from informal learning opportunities and ongoing support. Professional learning communities, where educators collaborate and share best practices related to technology integration, can serve as valuable platforms for continuous learning. Encouraging teachers to engage in self-directed learning, exploring online resources, participating in webinars, and joining social media communities focused on educational technology can also enhance their understanding and proficiency in teaching with technology. By nurturing a culture of continuous learning, teachers can stay updated on emerging technologies and pedagogical approaches, ensuring they remain effective facilitators of student learning in the digital age.

Furthermore, to support the training of teachers, educational institutions and policymakers should invest in the appointment of educational technology consultants and specialists. These professionals can provide guidance and mentorship to teachers, offering expertise in the selection and utilisation of educational technologies, as well as pedagogical strategies that

promote active engagement and academic achievement. Through their collaboration with teachers, educational technology consultants can facilitate the effective integration of new technologies and AI in teaching practices, leading to transformative learning experiences for students.

By prioritising the training of teachers to teach effectively with technology, educational institutions can foster a positive and productive technology-rich learning environment. This not only benefits teachers by enhancing their instructional capabilities but also empowers students by creating engaging and meaningful learning experiences. Furthermore, effective technology integration has been shown to improve student motivation, critical thinking skills, and overall academic performance.

In conclusion, the training of teachers to teach effectively with technology is crucial for successful technology integration in the classroom. By providing comprehensive formal and informal training opportunities, along with the support of educational technology consultants, teachers can develop the necessary skills and pedagogical knowledge to leverage technology in ways that maximize student engagement and promote academic achievement. Investing in the continuous professional development of teachers will pave the way for the successful and impactful integration of technology in teaching and learning.

#### **7.4 Contributions of the Study**

The impact of technology in the 21st-century world cannot be over-emphasized and seeking to successfully integrate technology into teaching and learning has become the focus for many researchers. Furthermore, researching various active learning strategies and their impact on learning has become important for successful technology integration. This has made this study of the impact of the Activated Classroom Teaching model on student learning and academic performance germane at a time like this.

This section, therefore, highlights some of the important contributions of this study, to the body of research and literature around this topic. The following theoretical and practical contributions have been noted:

- The study significantly contributes to the existing literature on student engagement by examining the impact of active learning strategies, specifically the ACT model. The findings and conclusions of this study provide valuable insights into how the implementation of the ACT model enhances student engagement, adding to the body of knowledge in this area.
- The study also contributes to the research and literature on the relationship between active learning strategies, such as the ACT model, and academic performance. By investigating the impact of the ACT model on academic performance, this study provides new evidence and understanding of how active learning can positively influence students' academic outcomes.
- The study demonstrates that the activated classroom teaching model has a substantial positive impact on the affective engagement of primary school students. These findings are particularly relevant for teachers and school leaders who aim to integrate technology into their instructional practices. By utilising the ACT model, educators can gain insights into maximising student engagement and creating meaningful learning experiences in the classroom.
- The study establishes that the implementation of the activated classroom teaching model positively affects students' academic performance. The findings highlight the importance of adopting the ACT model as a pedagogical approach to enhance student achievement. These results provide compelling evidence for teachers to embrace the ACT model and tailor their instructional practices accordingly.
- Additionally, the study establishes that when teachers incorporate suitable active activities and adopt student-centred instructional approaches, there is a significant increase in student learning. These findings highlight the importance of creating a student-centred learning environment that promotes active participation and engagement. By aligning instructional practices with student needs and interests, teachers can enhance the learning outcomes of their students.

By recognizing the significance of student-centred instruction and incorporating appropriate active activities, this study contributes to the existing literature on

effective teaching strategies. The findings provide valuable insights for teachers seeking to create dynamic and engaging learning experiences that foster student growth and achievement.

- Furthermore, the study emphasises the significance of training teachers to effectively incorporate technology and active pedagogy in their teaching practices. The findings underscore the need for continuous professional development and periodic training programs for teachers to ensure the successful implementation of appropriate teaching methods. By equipping teachers with the necessary knowledge and skills, this study contributes to the understanding of how to optimise student learning both inside and outside the classroom.

In summary, this study contributes to the existing literature by providing insights into the impact of the ACT model on student engagement and academic performance. The findings highlight the effectiveness of the ACT model in enhancing both affective engagement and academic outcomes. Moreover, the study emphasises the importance of teacher training and professional development and the importance of student-centred instruction and active activities in utilising technology and active pedagogy to promote student learning. These contributions expand the body of knowledge in the field of education and provide practical implications for teachers, school leaders, and policymakers.

## **7.5 Limitations of the Study**

Despite the success of this study, there are some limitations which must be taken into consideration when interpreting its findings and generalising its results. The following limitations apply to this research:

- A major limitation is the subjects used and the duration of the study. Only four subjects and the teachers of those subjects – Mathematics, Verbal Reasoning, French and Computer Studies were used during the intervention and were also the participants in the focus group discussion. Additionally, the entire intervention was carried out over seven weeks. It would have been interesting to see what the

results would look like if this study was done with more than four subjects and over a longer period.

- Another limitation of this study is that the study was carried out among students in a primary school in Nigeria. This study has not taken into consideration what impact the ACT study would have on tertiary students who are older and in other countries. It would be interesting to see if the results would be different across secondary or tertiary school students in Nigeria or in other African countries.
- Another limitation was the sampling method used in this research. The purposive sampling technique was used in this study. The school, subjects and participants were purposively selected and this limits the generalisation of findings. Future studies can ensure the use of a probability sampling method so that the findings can be generalized.

## 7.6 Further Research Directions

Even though this research has contributed to the body of knowledge and added to the literature on the subject of active learning strategies and student learning, the previous section has stated some limitations of the study. These allow for further research direction as follows:

- This study researched the impact of using the ACT pedagogy as an example of an active pedagogical approach to teaching with technology, on student learning with participants in a Nigerian primary school. It would be interesting to know what impact the ACT pedagogy would have on student learning among older students in tertiary institutions in Nigeria.
- Additionally, due to the nature of the research and the time limitations, the ACT intervention was carried out over seven weeks. It would also be interesting to see if the results would be different if the students were exposed to the intervention teaching over a longer period.
- Furthermore, this study made use of a non-probability sampling method. Further research can ensure the use of a probability sampling technique to investigate the

impact of teaching with the ACT model on student engagement and academic performance.

- Finally, with the rapid evolution of AI, further research could focus on the appropriate uses of AI in education. It would be beneficial to discover what impact AI would have on teaching and learning. Research can focus on how AI can help teachers teach effectively and how it can help students learn appropriately.
- Additionally, future research should focus on examining the long-term effects of student autonomy and choice on academic performance and the development of essential skills.

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## APPENDICES

### Appendix A: Ethical Clearance



14 April 2021

Mr Daniel Obatomisin Adeboye (215079552)  
School of Man Info Tech & Gov  
Westville Campus

Dear Mr Adeboye,

Protocol reference number: HSSREC/00002557/2021

**Project title:** Investigating the Effect of Using an Active Pedagogic Approach to Teaching with Technology on Student Learning

**Degree:** PhD

#### Approval Notification – Expedited Application

This letter serves to notify you that your application received on 03 March 2021 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 14 April 2022.

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 UZKZV guidelines.

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

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dt

#### Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag 354001, Durban, 4000, South Africa

Telephone: +27 (0)31 260 8350/4557/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/Research-Ethics>

Funding Campus: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

## Appendix B: Research Questionnaire and FGD Question Guide

Thank you for accepting this questionnaire. This questionnaire is confidential and will not be used to identify you as an individual. We appreciate you assisting us by completing this questionnaire. The results of this research will enable us to discover what impact the ACT model will have on your learning and especially how it actually impacts your engagement and academic performance.

Please be honest when completing the following details:

### SECTION A: DEMOGRAPHIC DETAILS

1. Class:            Primary 5             Primary 6
2. Gender:            Male             Female
3. Age: \_\_\_\_\_

### SECTION B: AFFECTIVE ENGAGEMENT

Please indicate how you feel about the following engagement factors by the extent of agreement using the following words: Strongly agree, Agree, Neutral, Disagree and Strongly disagree. Put a tick only in one box for each statement. If you make a mistake put a cross through the marked box and then tick in the correct box.

No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The class is boring					
2	I feel sleepy in class					
3	I wish the class period time is shorter					
4	I am happy when it is time for this subject					
5	I like this subject a lot					
6	I like my teacher					

### SECTION C: BEHAVIOURAL ENGAGEMENT

Please indicate how you feel about the following engagement factors by the extent of agreement using the following words: Strongly agree, Agree, Neutral, Disagree and Strongly disagree. Put a tick only in one box for each statement. If you make a mistake put a cross through the marked box and then tick in the correct box.

No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	I like to ask questions when I don't know it					
2	I like to do homework					
3	I pay attention in class					
4	I like to work on my own					
5	I like to finish my work					
6	When I'm in class, I pretend to be working					

### SECTION D: COGNITIVE ENGAGEMENT

Please indicate how you feel about the following engagement factors by the extent of agreement using the following words: Always, Often, Sometimes, Rarely and Never. Put a tick only in one box for each statement. If you make a mistake put a cross through the marked box and then tick in the correct box.

No	Statement	Always	Often	Sometimes	Rarely	Never
1	If it's too hard, I will skip it (R)					
2	Some subjects are too hard for me, I will fail (R)					

3	Even if it's hard, I will try					
4	I want to do more work					
5	I try to match what I already know with the things I am just learning					
6	I try to put new knowledge in my own words					

### **FOCUS GROUP DISCUSSION QUESTION GUIDE**

Introductions and thanking the group for availing themselves will be done. The purpose of the focus group discussion will be explained, including some ground rules.

The following questions will serve as a guide, with some probing questions were necessary.

- Explain briefly the teaching methods used prior to you being exposed to the ACT pedagogy?
- Explain briefly how you taught, using the ACT pedagogy in your subject?
- What do you like most about this new way you taught the students?
- How did teaching with the ACT pedagogy affect your students' engagement in the class? Why do you think it is so?
- In what way do you think how you taught will affect your students' exam results?
- Should other subjects be taught using this new approach/method? Why or why not?

## Appendix C: Tables

Table 15b: Test of difference of respondents' post-intervention academic performance across classes - Post hoc (LSD) test

(i)Class	(j) class	Mean diff (i-j)	Std error	sig	remark
Class 5A	Class 5B	12.50	10.58	0.241	not sig
	Class 6A	-27.83	11.52	0.018	sig
	Class 6B	-10.11	11.19	0.369	not sig
Class 5B	Class 5A	-12.50	10.58	0.241	not sig
	Class 6A	-40.33	11.52	0.001	sig
	Class 6B	-22.61	11.19	0.047	sig
Class 6A	Class 5A	27.83	11.52	0.018	sig
	Class 5B	40.33	11.52	0.001	sig
	Class 6B	17.72	12.08	0.146	not sig
Class 6B	Class 5A	10.11	11.19	0.369	not sig
	Class 5B	22.61	11.19	0.047	sig
	Class 6A	-17.72	12.08	0.146	not sig

Source: Field survey, 2021; p-value is significant at 0.05level

Table 16: Test of difference of respondents' pre-intervention academic performance across classes

Variables	Sum of squares	df	Mean squares	F	p-values	Remarks
Between group	15312.03	3	5104.01	0.734	0.534	Not sig
Within Group	611550.52	88	6949.43			
Total	626862.55	91				

Source: Field survey, 2021; p-value is significant at 0.05level

## Appendix D: Gatekeepers Permission Letter



### EXCEL KIDDZ FOUNDATION

21A Sanctuary Avenue, Onikoko, Abeokuta, Ogun State, Nigeria  
TEL: 091 21 351315

excelkiddz@gmail.com | www.excelkiddzfoundation.com.ng

15th October, 2019

Mr. Daniel Adeboye (215079532)  
School of Education  
College of Humanities  
Edgewood Campus  
UKZN  
Email: [danno4krist+phd@gmail.com](mailto:danno4krist+phd@gmail.com)

Dear Mr. Adeboye,

#### RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at our organization, Excel Kiddz Foundation, a nursery and primary school in Abeokuta, Nigeria, provided Ethical clearance has been obtained. We note the title of your research project is:

*"Investigating the impact of using an active pedagogic approach to teaching with technology on student learning".*

It is noted that you will be gathering your data by handing out questionnaires, making observations, taking pictures, having focus group discussions with 4 teachers in the school

Please ensure that the following appears on your questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form duly acknowledged by the research respondents;
- Gatekeeper's approval by the school management.

Data collected must be treated with due confidentiality and anonymity.

Yours sincerely,



Mr. Okenyi G. J. Ojima  
Headteacher

*A heart start in life ...*

## Appendix E: Turnitin Originality Report

Using an Active Pedagogical Approach to teaching... by Daniel Adeboye



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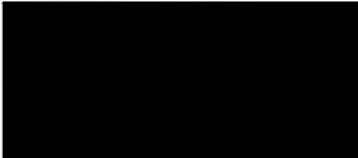
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I declare that:

**INVESTIGATING THE IMPACT OF USING AN  
ACTIVE PEDAGOGIC APPROACH TO TEACHING  
WITH TECHNOLOGY ON STUDENT LEARNING**

A THESES BY  
DANIEL OBATOMISIN ADEBOYE

has been proofread and edited by me. This covered language editing, grammar and spelling check. The work was revised for style, clarity, consistency, word choice, sentence structure, natural expressions and flow. I did not influence the academic content.



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