THE DESIGNING OF A LEARNING THEORY TO PROMOTE A CLASSROOM PEDAGOGY FOR MOODLE SELF-DIRECTED LEARNING

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Abstract. The higher education institutions across the world have changed their teaching and learning methods due to the Covid19 pandemic. They are now using different learning management systems like Moodle. The implication of the sudden transition to online learning is that students now have to become more independent, and self-directed in their learning. The aim of this paper is therefore to develop a Moodle (Modular Object Oriented Dynamic Learning Environment) Self-Directed Learning Theory. It explores some of the learning aspects related to the development of students towards Moodle self-directed learning and proposes a framework of skills that lecturers and teachers can use as a guide to increasing student responsibility. This study is situated within the theory of Instrumental Genesis (IG). The researchers employed the design-based research method when developing this learning theory. The process of developing this learning framework involved a literature review of Moodle and self-directed learning theories. The study of the learning theories revealed various Moodle and self-directed perspectives which were used to develop this learning theory. The outcome of this study is a learning theory that will hopefully promote self-directed learning within the context of Moodle teaching and learning.

Keywords: Autonomous; Moodle; Learning theory; Self-Directed Learning

I. INTRODUCTION

The higher education institutions across the world have changed their teaching and learning methods due to the Covid19 pandemic. There is a paradigm shift in the way lecturers deliver quality education. They are now using different learning management systems as powerful media of learning and as a mode of deliverance to maintain both positive educational outcomes and keep students safe and healthy. Online learning therefore became a lifeline for institutions of higher education during this covid 19 pandemic era. Students have to become engaged in online learning, which requires a high level of self-directedness. The response to this challenge can be to develop self-directed learning theory which will assist students to become self-directed learners.

The sudden transition to online learning has shifted from lecturers to students (Hong *et al.*, 2021). The implication of the sudden transition to online learning is that students can no longer follow a well-coordinated, structured learning schedule that is guided and supervised

on campus; rather, online learning. Students now have to become more independent in their learning. Independent learning encourages students to be proactive and independent, a philosophy aligned to self-directed learning (SDL). The COVID-19 pandemic has therefore necessitated the use of student centred and self-directed learning teaching and learning strategies because classes are now conducted online. Students are now expected to be self-directed learners. SDL has to do with students' readiness or willingness to learn independently, which consists of components of attitudes, abilities, and personal characteristics and is responsible for their own learning outcomes (Bhandari *et al*, 2020). SDL is now used as a benchmark to measure the students' achievement of learning outcomes.

One of the most used LMS to deliver online teaching and learning at universities is Moodle (Cabero-Almenara *et. al*, 2019). Djamel and Mohamed (2021) argue that Moodle is a popular open-source learning management system that delivers a set of learner-centric tools and collaborative learning environments that empower both teaching and learning. Moodle builds the tools into an

interface that makes the learning task central. It is built on social constructionist pedagogy, including the tools that are required in an online learning environment. The use of Moodle has become a critical teaching and learning tool all over the world and its impact on curriculum delivery cannot be over-emphasised (Mthethwa-Kunene & Maphosa, 2020).

The Objective and Significance of the Study

The ultimate goal of this study is therefore to design a Moodle learning theory that can help promote self-directed teaching and learning. The findings will therefore inform the development of a generic ICT teaching theory that will promote Moodle self-directed teaching and learning. It is hoped that the theory will be used to bring about a paradigm shift in the universities approach towards self-directed teaching and learning using Moodle. This study is timely as online learning has become increasingly popular in this era which is plagued by the covid 19 pandemic. University students are expected to be self-directed in their studies (Dresel *et al.,* 2015). Developing a learning theory that promotes self-directed learning within an online context will therefore assist in fostering self-directed learning, assist students in becoming self-directed and lifelong learners for the 21st century (Du Toit-Brits, 2020).

II. METHODOLOGY

This study is underpinned by the design-based research approach. According to Anderson and Shattuck (2012), a design-based research approach is a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among a researcher and practitioners in real-world settings and leading to contextually sensitive design principles and theories. The goal of design-based research is therefore to design and develop interventions (e.g., programs, teaching and learning strategies, materials, systems) to solve complex problems (Stemberger & Cencic, 2014). The design-based research approach is appropriate for this study, as the aim is to bridge the gap between theory and practice by designing and developing a Moodle mathematics learning framework which will promote mathematics self-directed learning.

This study is informed by the theory of Instrumental Genesis (IG). This theory fits in well with the designed framework because it does not only deal with the integration of technology in the classroom, but also, being derived from the work both of Vygotsky and of Piaget, has links to socio-cultural approaches (Rabardel 2002). The researcher collected data by reviewing literature from both Moodle and self-directed theories. This includes amongst others the Self Determination Theory (Cockerill, 2014); Learner Autonomy Framework, (Reinders, 2010); Self - Regulation Theory (Bandura, 1977); The Technological Pedagogical Content Knowledge (TPACK) teaching

framework (Mishra & Koehler, 2006) and (Schmidt *et al*. 2009); The Unified Theory of Acceptance And Use of Technology (UTAUT) teaching model (Venkatesh, Morris, Davis, & Davis 2003). The review looked at the theories which, on the one hand, reflects the same or a similar teaching-learning value system as that embodied in Moodle and self-directed learning but can, on the other hand, provide it with a stronger pre-theoretical and theoretical underpinning, that is, a stronger transcendental system that explains the existence of the theory and its application. These theories were analysed to identify those aspects, principles and characteristic which help promote self-directed learning. The researcher used these to design a Moodle self-directed learning theory.

III. RESULTS AND DISCUSSION

The Main Aspects Of The Moodle Self Directed Learning Theory

In this section the researchers present and discuss the design of a Moodle learning theory to promote self-directed learning. Figure 1 graphically illustrates the Moodle Self Directed Learning Theory (MSDLT) that emerged from this study. The building blocks of this learning theory are online computer literacy prior knowledge, the usability of Moodle, the SDL perspectives which guide the self-directed learning process, the behavioural indicators of the SDL learning process, and the outcomes of the self-directed learning process.
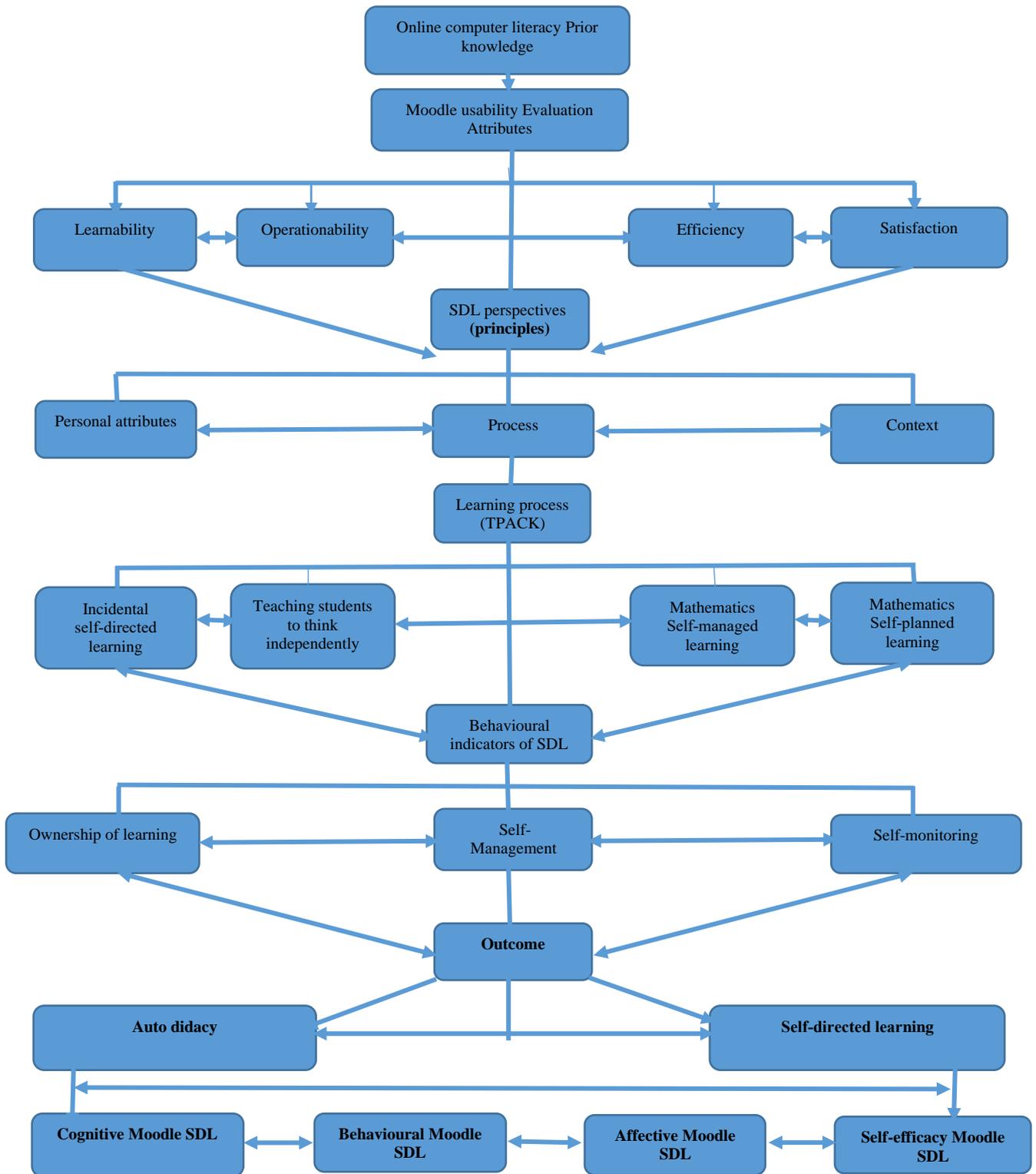
Figure 1 The Moodle self-directed learning theory.

Online Computer Prior Knowledge

Prior knowledge is the knowledge the student already has before they meet new information. The study by Butcher and Sumner (2015) found that many university students begin their online programs with limited knowledge of computers but quickly find themselves immersed in the use of technology for learning and communication. This is really overwhelming for them. According to O'Donnell *et al.,* (2014), the students' computer prior knowledge is important because it influences students' online learning behaviors and has a bearing on the relationship between these behaviors and students' eventual online learning skills outcomes. The rationale for why online prior knowledge plays a strong role in online learning can be drawn from research and theory in cognitive psychology. Relevant prior knowledge forms a framework for incoming information, allowing new materials to be integrated into a flexible knowledge representation that can be transferred to new situations (Hixon *et al*., 2016). Without a conceptual framework of prior knowledge into which incoming information can be integrated, students typically focus on memorising isolated facts that can be recalled but cannot be applied outside of the context in which it was learned.

According to Butcher and Sumner (2015), a common problem faced by lecturers in online education at universities is that students lack important online computer prior knowledge. The study by Shen *et al.,* (2013) found that the number of online courses taken previously by a student was related to their online learning self-efficacy. Specifically, they found that students with more extensive prior online learning experience demonstrated higher self-efficacy to complete an online course and collaborate with other students on academic tasks. Related to this, a study by Wang *et al*., (2013) also found that students who have taken online courses previously utilized more effective learning strategies in their online courses. Further, students who used more effective learning strategies also demonstrated increased motivation for their online coursework. These findings suggest that students with prior online learning experiences are better suited to complete their online courses successfully. Not only are students with prior experience more likely to be successful learners, but they also experience benefits in the affective domain of learning such as better attitude and satisfaction with their courses (Wang *et al*, 2013). These findings suggest that students who have more extensive prior online learning experience are better prepared to be successful, have more confidence in their ability to be successful, and thus tend to have more favorable views of online learning.

Also, the study by Butcher and Sumner (2015) found that students with more extensive online experience (those who have taken seven or more online courses) differed in their ratings of items related to clear expectations for interaction and ease of navigation. In general, those with more online experience rated these items as more important than online learners with less experience. Prior knowledge is thus likely to have strong effect on students' behaviors and strategies

when engaging in online learning tasks. Some other studies have indicated that previous online learning experience may be a significant factor in future online courses outcomes. Haverila (2011) found that prior learning experience was a significant contributor to learner's perceived efficiency of online learning and learner productivity, although this study was limited in that it only looked at one online undergraduate course. More recently Hachey *et al*., (2014), looking at 129 online courses in a large, urban community college, found results that show that prior online course experience is strongly correlated with future online course success

According to Butcher and Sumner (2015), prior knowledge is regarded as a predictor of online learning behaviours, and it links with the students' ZPD (see figure 2). Vygotsky (1979) defines the zone of proximal development as 'the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers. Zone of Proximal Development (ZPD) is one of the most highlighted concepts of Lev Vygotsky's work, implying the potential level an individual could attain with the aid of other competent individuals. The goal of education in Vygotsky's study is to ensure students are placed in their own ZPDs as much as possible by presenting intriguing tasks, meaningful learning experiences, and problems that are of certain difficulties and this requires assistance from capable peers and facilitators. Vygotsky believed that when a student is in the ZPD for a particular task, providing the appropriate assistance will give the student enough of a boost to achieve the task.
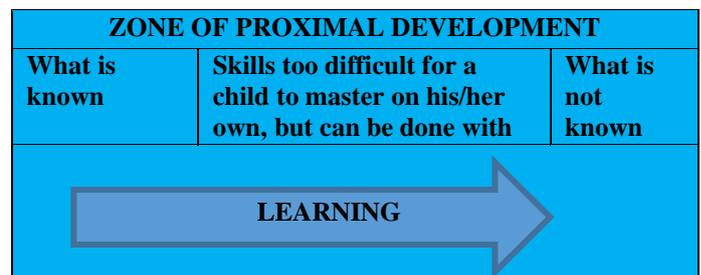

Figure 2 The Zone of Proximal Development (ZPD)

This learning theory conceptualises that for students to be truly online self-directed, the starting point should be what is known by students, their abilities, and capabilities. Their online prior knowledge should be the foundation upon which their online education is based. Students' online education should also be on the students' ZPD. This learning theory designed thus considers the students' ZPD and prior knowledge as a starting point for Moodle self-directed learning. The starting point is the student and his or her actions. The researchers argue that these actions can be encouraged, modelled and monitored by the lecturer.

Within the ZPD, Moodle should then be used as a technological mediation tool that mediates the process of

learning to achieve self-directed discovery learning. Moodle becomes a mediator to enable students to continuously challenge themselves in order to facilitate new knowledge based on experiential and collaborative efforts.

Moodle Usability Evaluation Attributes

The International Organization for Standardization defines usability as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of user (ISO 1988). According to Capece and Campisi, (2013), usability attributes primarily focus on how to use Moodle. Moodle usability attributes help to apprehend how effective and usable Moodle is for being used for teaching and learning (Navimipour & Zareie, 2015). The usability attributes therefore help with the Moodle navigation skills which assist students to find the information they're looking for with ease.

Nielsen (1994) argues that usability increases learnability which in the world of online learning, refers to the ability of users to effectively learn and retain the skills and knowledge. Moodle usability attributes which assist students include Moodle Perceived Usefulness (MPU) and Moodle Perceived Ease of Use (MPEOU). Moodle Perceived usefulness (MPU) indicates "the degree to which a student believes that the use of Moodle will improve his/her performance" (Davis, 1989). MPU is defined as "the extent to which a student believes that using Moodle will enhance his or her performance. PU can be a strong determinant of intention to use Moodle" (Jonas & Norman, 2011). The usefulness of a Moodle in teaching is closely connected to how the lecturers can use the Moodle to engage students. The usefulness of Moodle is the most important factor to conceptualize the quality of learning and teaching in university setting. Lecturers and students will adapt to Moodle teaching system if it helps them in achieving their purposes. Perceived usefulness is also impacted by perceived ease of use. Moodle Perceived ease of use (PEOU) refers to the "degree to which a student believes that the use of a Moodle will be uncomplicated" (Davis, 1989). MPEOU is defined as "the extent to which a student believes that using Moodle will be relatively effortless" (Jonas & Norman, 2011).

In this learning theory, usability is defined in terms of learnability, operationability, efficiency and satisfaction. According to Esgi (2013) usability of e-learning systems influences the way students performs in an online learning. If usability of online learning system is bad, students fail in their attempt to use the system. Below are the four characteristics of usability evaluation which contributed to the development of this framework (Esgi, 2013):

1) *Learnability:* concerned with how easy is it for students to accomplish basic tasks the first time they encounter the design when using Moodle. If students find Moodle is easy to learn; it will make it easier for them to develop mathematics problem solving skills without constant coaching throughout the session.

2) *Operationability:* concerned with the ability of the students to perform the functions of Moodle. This is an important factor in the user friendliness of Moodle. This will promote Mathematics self-directed learning.

3) *Efficiency:* This is about how quickly students can they perform tasks once they have learned to use Moodle. In mathematics teaching, this may result in a high level of productivity.

4) *Satisfaction:* concerned with how pleasant it to use Moodle. In terms of Mathematics learning students should enjoy using the software and be satisfied with their time spent to achieve self-directed learning.

Perspectives on Self-Directed Learning

This learning theory incorporates Garrison's Three-Dimensional Model of SDL. Garrison's model of SDL involves the personal attributes as well as a learning process as the perspectives of SDL and the learning context (Garrison, 1997).

1) *Personal Attributes:* An attribute is defined as a quality or characteristic of a person. Personal attributes refer to students' motivations for and capability of taking responsibility for their learning when using Moodle (Deci & Ryan, 2012). Personal attributes therefore refer to learners' motivations for and capability of taking responsibility for their learning. It also includes the use of resources and cognitive strategies. These personal attributes/ characteristics of learners in a specific learning context, together with their prior knowledge of the content area and prior experience with the learning context affects the learning outcome. Personal attributes involve all the characteristics students bring to a specific learning context together with their prior knowledge of the content area and prior experience with the learning context. All individuals are capable of self-directed learning, but the degree of development varies due to their individual differences, including learning motivation, self-efficacy, self-esteem, conscientiousness, openness to experience, even intelligence.

The study by Cazana and Schiopca (2014) did a correlation and multiple regression analyses to examine the relationship between personality traits and students' self-directed learning. The results revealed that self-directed learning and personality traits are correlated. Students' personal attributes therefore have influence on self-directed learning.

2) *Processes:* Processes refer to students' autonomous learning processes (Deci & Ryan, 2012). These processes include planning, monitoring, and evaluating one's learning. These processes promote self-directed learning and independent thinking. They also enhance

problem solving skills. Students' autonomy is primarily manifested in the process of planning, monitoring, and evaluating one's learning (Deci & Ryan, 2012). The goal of SDL is to help students to develop autonomy in the learning process. Simply, autonomous learners refer to the learners' ability to do work independently without other's direction.

In the Moodle learning scenarios, where the structure of the curriculum is online, students have more flexibility in deciding when, how, and with what content and activities they engage (Milligan & Littlejohn, 2014). This flexibility requires students to monitor and adjust their behaviour and actions concerning the specific learning context. Students are aware of their learning responsibility in themselves instead of an external source, such as a teacher (Demir & Yurdugül, 2015). A self-directed learner tends to actively engage in the learning processes, such as acquiring information, planning and evaluating the learning activities. Active learning strategies can increase students' participation and improve the learning process and performance (Freeman *et al.*, 2014; Yilmaz, 2016).

3) *Context:* Context refers to all the environmental factors and how those factors impact the level of self-direction provided to the student. This includes both the instructional design elements and support elements. Design elements include the resources, structure and nature of the tasks in the learning context. These resources could be embedded in the specific learning context and could be designed by the instructor as instructional support. Similarly, the specific learning context may decide on the structure of the course. The support can come from the instructor's feedback or peer collaboration and communication.

Learning Process: Moodle and SDL

According to Gibbons (2002), there are various phases in SDL and these phases start as a low degree of self-direction to the highest degree of SDL. The first phase is called Incidental self-directed learning: this involves the occasional introduction of SDL activities into courses or programs that are otherwise teacher-directed. The second phase is teaching students to think independently. The programmes introduced by the lecturer need to emphasise the personal pursuit of meaning through exploration, inquiry, problem solving and creative activity. The third phase is Self-managed learning: Courses or programs presented through learning guides that students complete independently. The fourth phase is self-planned learning: Courses or programs in which students pursue course outcomes through activities they design themselves. Self-directed learning is the fifth phase. This involves courses or programs in which students choose

the outcomes, design their own activities and pursue them in their own way.

Behavioural Indicators of SDL

Lecturers to recognise the behavioural indicators of SDL in order for them to encourage SDL amongst their students. Deci and Ryan (2012) identify ownership of learning, self-management and self-monitoring and extensions of learning as the most notable behavioural indicators of SDL. These behavioural indicators can help lecturers monitor whether their students are engaging in SDL activities. This may in turn serve as useful information when planning instructional strategies.

1) *Ownership of learning:* Ownership of learning has to do with personal responsibility. Brockett and Hiemstra (1991, p. 27) argue that personal responsibility is the 'cornerstone of self-direction in learning'. Students who take personal responsibility in learning have ownership of their learning. They are capable of setting their own learning goals and accept the consequences of their thoughts and actions. Students should therefore identify, determine and articulate their own learning goals and develop a sense of ownership of learning.

2) *Self-management:* Deci and Ryan (2012) use the term self-management to describe the aspect of behavioural task control relating to management of learning activities. Self-management on self-directed learning is a process to manage oneself to achieve the desired goals. Managing ourselves is very difficult if not balanced with planning, continuous implementation, and self-evaluation. The steps in self-management are growing self-motivation, planning detail activities, doing continuous activities, and evaluating the obstruction that occur during the activity.

Students should develop the ability to manage of external tasks and resources. They should also develop the ability to make sound decisions, self-plan and self-manage their time, Students should continuously and critically reflect on their learning and initiate gathering of feedback from teachers and peers to achieve their learning goal. This is a recipe for self-directed learning. High level of self-management is important in SDL and students need to adopt different strategies in dealing with various problems and challenges.

3) *Self-monitoring:* According to Deci and Ryan (2012), self-monitoring focuses on both cognitive and metacognitive aspects of learning, which are internal to the students. Cognitive processes (e.g., thinking, making meaning of the information, and integrating new knowledge into existing knowledge structure) are necessary in all learning processes. Metacognition refers to thinking about thinking or learning to learn,

which is related to learner's ability to reflect on their learning. This aspect of SDL is close to self-regulated learning. For this reason, Deci and Ryan (2012) suggest regulating one's learning by self-observing, self-judging and self-reacting to the learning tasks and performance. Even though self-monitoring involves internal cognitive processes, external factors such as feedback from the teacher or others can influence a learner's reflection. Students should therefore develop skills are that will help them to meet the challenges they set for themselves through self-monitoring.

Outcome

The ultimate outcome of any self-directed learning is autodidaxy. Autodidaxy means self-teaching. It involves learning situations where students control the choice of what to learn, where to learn, how to learn, and how to evaluate learning. Lecturers should play the critical role of motivating students to initiate learning challenges and helping them to develop their competency in managing and monitoring their learning which will lead to autodidaxy or self-teaching.

According to Asiri and Shukri (2020), a highly self-directed student is an autonomous learner, who believes his/her own efforts can cause his/her behavioral changes, similar to the learner with a high level of internal locus of control. They further argue that a student with a high level of internal locus of control believes that he/she has control over the external events which can affect his/her learning behavior. A highly self-directed autonomous student therefore exhibits initiative, independent persistence in learning, accepts responsibility for his/her own learning, is capable of self-discipline, and open to learning opportunities. He/she has the ability to choose what has value, to make choices in harmony with self-realization. Students should therefore be encouraged to do more independent work so as to be autonomous.

Previous research indicate that learning environments have an impact on cognitive, behavioural, affective, and self-efficacy aspects of learning (Peerapolchaikul *et al*., 2019; Bhat M.A. *et al*., 2016; Stephan *et al*, 2019). In Moodle teaching and learning, one of the indications that self-directed learning has been achieved is the acquisition of online cognitive skills, online behavioural skills, online affective skills, and online self-efficacy skills. The outcomes of students' self-directed learning are manifested in these skills.

Self - efficacy in Moodle learning is an important factor for student participation and performance in Moodle learning. It is important for students to be confident in their technology skills because Moodle courses are being taught online. According to Peerapolchaikul *et al*., (2019), self - efficacy is an important factor in understanding the frequency and success with which individuals use Moodle for self-directed learning. A highly self-directed learner believes he/she has the ability implement his/her own plan and persist to accomplish the achievement. Self-efficacy can

therefore help predict students's performance accomplishments both directly and indirectly through its influence on self-set goals.

Cognitive skills should also be manifested in the outcomes of students Moodle self-directed learning. Cognitive skills are mental skills used in the process of acquiring knowledge, the manipulation of information, reasoning, and problem-solving (Bhat M.A. *et al*., 2016). The study by Meza-Fernández and Sepúlveda-Sariego, (2017) found that Moodle promotes cognitive learning. Cognitive Learning is a type of learning that is active, constructive, and long-lasting. It engages students in the learning processes, teaching them to use their brains more effectively to make connections when learning new things. Studies have shown that cognitive skills are a determining factor of an individual's learning ability, in essence, when cognitive skills are strong, learning is fast and easy (Bhat M.A. *et al*., 2016; Pentaraki & Burkholder, 2017). According to these studies, when cognitive skills are weak, learning becomes a challenge. Cognitive skills go beyond basic observation of facts and memorisation, they help students to be evaluative, creative, and innovative, which increases their self-directed learning

Cognitive learning has some educational benefits. It improves comprehension and encourages students to take a hands-on approach to learning. This allows students to explore the material and develop a deeper understanding. It helps develops problem-solving skills. The cognitive learning helps students build transferable problem-solving and study skills that they can apply in any subject.

One of the skills to be achieved by online self-directed learning in Moodle learning is good online behaviour. Lecturers should create a positive environment, which dovetails nicely with developing positive behavior management in the online classroom. To promote good online behaviour, lecturers should clearly state the goals and objectives of Modules and lessons. By explicitly stating the learning objectives and goals of the lesson, the students can map out in their mind what they need to accomplish during the class time. If they start to detour from the main objectives, it helps to restate them and gently remind them of the goals. The lecturer should also define your behavioral expectations. All students know the rules in a regular classroom, but they aren't quite sure what to expect in this new virtual world. The lecturer should clearly state the rules for positive behavior management in the online classroom.

Online learning environments have an impact on affective aspects of learning. Online classes, by their very nature as distance learning experiences, present barriers to student engagement and learning. These barriers are a primary reason that we see low student engagement and higher attrition rates in online classes (Stephan *et al*., 2019). Emotions are a powerful tool to fight for online student attention, engagement, and persistence. When students are stressed, overwhelmed, or excited, they often act out, disrupting activities or disobeying rules. When they understand how their emotions drive their behavior, however, they can express how they feel in more acceptable

ways. Self-awareness and self-management are key to managing emotions; the former helps students recognize their emotions, and the latter helps them regulate their emotions. Students who have these two skills are able to recognize their strengths, develop a growth mindset, control impulses, and set goals, according to Understood. This learning theory is recommended for Moodle teaching to promote self-directed learning.

IV. CONCLUSIONS

This study has addressed issues surrounding Moodle self-directed learning. The study particularly focused on designing a Moodle self-directed learning theory for a formal educational context and specifically aimed to students to work independently and be autodidacts. The research questions were as follows: What are the core aspects and characteristics (principles) of Moodle teaching and learning in a formal educational context? Which of these core aspects and characteristics will promote self-directed learning?

To be able to answer the research question and designing a Moodle Self Directed learning theory, the researchers did an extensive literature review on Moodle and self-directed teaching and learning. The study found the following key elements and characteristics to be crucial to a Moodleself-directed learning theory: the students' prior knowledge, Moodle usability evaluation attributes, self-directed learning perspectives, learning theories and behavioural indicators of self-directed learning. The theory advocates that the successful implementation of Moodle towards self-directed learning is informed by the Moodle usability evaluation attributes which will stimulate and trigger self-directed learning. Self-directed learning is best achieved within a rich learning process through either the TPACK or UTAUT teaching frameworks. Self-directed learning will manifest itself within the behavioural indicators of SDL. The outcome of such a learning process is auto didacy.

The structure of this framework clearly shows that developing self-directed learning is a lengthy process and its successful implementation will therefore depend, to a large extent, on the persistence of the lecturer in assisting students to understand the dynamics and principles of self-directed learning. Uys and Citanda (2020) argue that it is not realistic to expect students to take responsibility for their learning from one day, or even month, to the next. Autonomy develops gradually and is a mindset that calls for certain skills, not the other way around. The overall classroom atmosphere needs to value and encourage reflection and the students' own views and roles in the learning process (Voskamp, Kuiper, & Volman, 2020).

This learning theory will help in the satisfaction of the students' needs for self-determination and autonomous learning. This is at the heart of this learning theory as shown in figure 3.
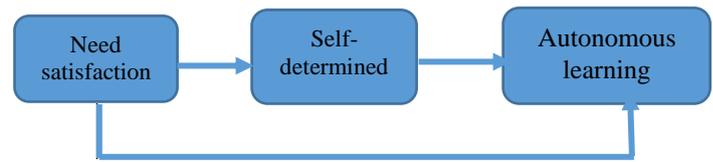
Figure 3: The mechanism of developing learner autonomy

The researcher argues that this framework will help satisfy the students' basic needs for autonomy, competence. Their motivation and learning behavior will be more self-determined. This will then their behavioral regulation will change from introjection into identification which will lead to self-directed learning. The researchers' view is that this will then motivate and empower students to move along the student autonomy continuum progressing from being dependent to being autonomous and independent. This will then translate to self-regulated and autonomous learning which will ultimately contribute to better academic achievement of Moodle self-directed learning.

Further research needs to determine how best to use this learning theory to promote self-directed learning in line with the current theories of classroom and lifelong learning. Technology is evolving rapidly and each student is unique. Supplementary research is therefore needed to determine how best to adapt this learning theory to other educational contexts and how best to can cater for the individual needs of students.

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