Article

Feasibility of Modularisation in Teaching and Learning Mathematics Through ODeL in Teacher Education

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Abstract

The purpose of this study was to explore the feasibility of utilising the modular approach to teaching and learning mathematics within the context of open and distance electronic learning (ODeL) at two institutions of higher learning in Zimbabwe. Over the past three years, there has been a notable emphasis on delivering mathematics education within a technological framework at many Zimbabwean universities, thereby necessitating the implementation of a modular system. Modularisation entails partitioning the curriculum into discrete units that are delivered over short durations. Students accumulate credits from individual modules assessed monthly, which subsequently contribute to their final grade for the programme. However, despite being commended as a system capable of enhancing the quality of mathematics learning, modularisation has received scant regard from several scholars. In mathematics education, extended study time correlates with improved performance, highlighting the uncertainty regarding the ability of this system to impart foundational knowledge within a mere three weeks prior to final examinations. This qualitative study explored the feasibility of the modular system of learning by unravelling the experiences of mathematics education instructors and students with the modularisation programme implemented at two state universities in Zimbabwe. The findings suggest that modularisation may hinder mathematical innovation, as it risks fostering examination-oriented behaviours among learners, resulting in superficial understanding because of continuous assessment conducted in "bite-sized" pieces, ultimately leading to a reduction in the time allocated for comprehensive knowledge delivery.

Keywords: curriculum; higher education; mathematics knowledge; modularisation; ODeL learning; quality learning

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Introduction and Background

The primary objective of this study was to thoroughly investigate the feasibility of implementing a modular approach to teaching and learning mathematics within the framework of open and distance electronic learning (ODeL) at higher education institutions in Zimbabwe. Over the past three years, there has been a notable increase in efforts to incorporate advanced technological tools into the educational landscape of Zimbabwean universities, particularly in the fields of mathematics and science. This evolution not only signifies a shift in pedagogical methods but also highlights the institutions' commitment to fostering an engaging and supportive learning environment for students. By exploring this modular approach, we aimed to identify innovative strategies that can enhance mathematical understanding and academic success among learners in this evolving educational context. Furthermore, this modular initiative was implemented to ensure that students not only acquire knowledge but also apply it effectively, thereby improving proficiency across all areas of learning.

The modular system was implemented in Zimbabwe during the onset of the COVID-19 pandemic. According to Dejene and Chen (2019), this educational framework segments the curriculum into discrete units that are delivered over relatively brief periods. Such a mode of learning entails concentrated bursts of instruction in one to two modules or courses, followed by an examination. In 2023, other universities in Zimbabwe adopted a similar modular approach, albeit with a minor variation whereby the academic semester is divided into four quarters instead of monthly units. In the studied state institutions utilising the modular system, students engage with individual modules over a three-week period, culminating in examinations during the fourth week. Consequently, students accumulate credits for each module completed on a monthly basis, which ultimately influences their final programme grade. Modular learning is primarily centred on specified learning outcomes, and its efficacy is contingent on the alignment of these outcomes with course design. This alignment ensures that both outcomes and course structure collectively contribute to a constructively aligned course framework (Dejene and Chen 2019).

The application of a modular system in online learning is recognised for enhancing learner autonomy and enabling students to exert greater control over their educational experiences. Dejene and Chen (2019) emphasise that, within this modular framework, students are more inclined to take responsibility for their own learning outcomes. As noted by Mapfumo (cited by Gora 2023), during the 2022 graduation ceremony, the benefits associated with the modular system include improved content retention and higher pass rates among students. This improvement can be attributed to the continuous assessment practices, where feedback and grades are provided daily, thereby minimising opportunities for procrastination among educators. Furthermore, the modular approach emphasises detailed assessments concerning each component of the curriculum, rather than providing broader course definitions (Dejene and Chen 2019). This specificity has positioned the modular system as the most effective methodology for curriculum implementation in higher education, leading to significant enhancements in the quality of learning and content delivery.

The trend towards modularisation in higher education institutions in Zimbabwe has garnered significant attention, particularly within state universities. As noted by Dejene and Chen (2019), this approach has emerged as a notable trend across various African universities. In Ethiopia, for instance, modularisation was introduced in 2013. Despite receiving praise for its potential to enhance the quality of learning, this system has not been universally embraced, with other institutions expressing concerns regarding the quality of education it purportedly ensures. Research indicates that extended study periods correlate with improved performance in mathematics (Ryan et al. 2021; Spitzer 2022). Consequently, it remains uncertain how a modular system can effectively impart fundamental knowledge of mathematics within a compressed timeframe of three weeks leading up to final examinations. This study, therefore, investigated the feasibility of modularisation in the teaching and learning of mathematics through open and distance e-learning (ODeL) at two universities in Zimbabwe. The study addressed the following questions: What are the experiences of undergraduate mathematics students regarding the modularisation approach? How do students and lecturers at higher education institutions perceive modularisation in the context of teaching and learning mathematics? How does modularisation contribute to enhancing mathematical literacy and proficiency?

Literature Review

Universities serve a critical function as leaders in the domains of teaching, learning, education, research, and technology. In their educational activities, universities offer professional training essential for high-level employment, alongside the education necessary for the socio-economic advancement of a nation (Yang et al. 2015). In an effort to enhance teaching and learning methodologies and to elevate the quality of education, numerous state universities in Zimbabwe have implemented a modularisation system of instruction. This approach is not without precedent in higher education; it was first established in 1869 by institutions in the United States (Dochy et al. 1989). In Zimbabwe, the modularisation system was pioneered by the University of Zimbabwe in 2021 and subsequently adopted by other governmental universities in 2023. It is important to differentiate modularisation from a semester-based system, as the two concepts pertain to distinct methods of curriculum organisation (French 2015). The primary distinction lies in the fact that in modularisation, modules are not delivered throughout the entire semester but are instead taught and assessed over a condensed time period within the semester.

According to Gora (2023), the modular teaching and learning model consists of short instructional periods, typically lasting approximately three weeks, within a single course, followed by an examination in the fourth week. Dejene and Chen (2019), along with French (2015), characterise modularisation as a framework in which the curriculum is segmented into discrete units that are delivered over brief durations.

Rather than encompassing all modules within a condensed semester, assessments are conducted piecemeal (Makuvire and Mhishi 2024), which has been regarded by some as a means of alleviating examination-related stress. In the context of Zimbabwe, the modularisation system represents a pedagogical approach in which modules are not taught for the full duration of the semester. Instead, they are instructed and assessed over shorter intervals. Each semester is subdivided into multiple units. According to Gora (2023), referencing Mapfumo, the rationale behind implementing the modular learning model is to allocate sufficient time for students to concentrate on one or two modules within a specified timeframe, thereby enhancing content retention. Mapfumo as referenced by Gora (2023) further emphasised that modular learning enables students to dedicate their full attention and energy to a single module, or at most, two modules, in contrast to the traditional semester-based teaching model. Despite being a relatively new and promising educational approach in the country, Mapfumo, as indicated by Gora (2023), expressed concerns regarding certain lecturers who are struggling to adapt to the new system and remain entrenched in old methodologies. Lecturers from various universities across the nation have acknowledged the benefits of this system, noting that it diminishes the time spent in lecturer-student interactions and encourages students to pursue independent learning (Makuvire and Mhishi 2024). Feedback obtained through the University World News as referenced by Gora (2023), reveals that several students believe this system has simplified their academic experience, as the assessments are less frequent at any given time, allowing them to focus on one subject at a time. Nonetheless, there remains a concern regarding whether students are genuinely comprehending concepts or merely memorising information to succeed in the examinations. As posited by Kurebwa (2022), students often study exclusively for assessments, leading to the perception that anything outside the scope of the examination is irrelevant, which may inhibit innovation, creativity, and explorative learning.

In the context of ownership within a modular system of learning via ODeL, Rodeiro and Nadas (2005) argue that students are afforded the opportunity to plan their academic work, thereby assuming responsibility for their own learning. This autonomy enables students to regulate their pace and to complete examinations only after they have thoroughly grasped the relevant concepts. However, the implementation of modularisation is not without challenges; despite the brief duration allocated for each module, typically three weeks, assessments are conducted according to the rigorous standards of a Bachelor of Science in Education (BScEd) in mathematics, with no consideration for the maturation process (Rodeiro and Nadas 2005). Critics of the modular assessment system, including Ertl and Hayward (2010), contend that it may precipitate a decline in public confidence regarding the credibility of qualifications, leading to a diminution of trust in the qualification among the general public. This scepticism arises from the perceived inflexibility of the system, which does not allow students to engage with modules at their most opportune times, thereby misaligning assessments with the level of learning achieved. Rodeiro and Nadas (2005) further note that the frequency of assessments within the modular framework is significant, resulting in examinations that are conducted in a fragmented manner. For instance, an entire unit or module may be assessed within the initial four weeks of a three-year programme, which can lead to retention issues by the time students complete their studies. The literature thus asserts that this fragmentation creates a lack of coherence in learning experiences, potentially jeopardising "synoptic understanding." Consequently, the process does not facilitate incremental learning, resulting in a disrupted overall comprehension of the course material. Similarly, Mushauri (2023) posits that modularisation can lead to a disjointed and incoherent educational experience, thereby undermining learning outcomes. Moreover, Mushauri (2023) contends that the reliance on the modular framework fosters a student orientation that prioritises examination performance over exploration of academic knowledge and innovation. This implies that the approach may ultimately detract from the fundamental objectives of the Education 5.0 model, which aims to cultivate graduates equipped to innovate and contribute to industrialisation. Despite the criticisms surrounding modularisation, the implementation of continuous assessment and the provision of regular feedback, necessitated by the limited timeframe for examinations, can effectively aid in identifying students' needs (Dejene and Chen 2019). This means that the approach allows for the adaptation of teaching methods and the refinement of pedagogical strategies based on the outcomes of assigned tasks. Consequently, the curriculum can be structured to address the specific needs of students within the modularisation framework (Ali et al. 2010). However, Thomson (1988) argues that continuous assessment and the preparation of study materials by educators involved in modularisation detract from the valuable time that could otherwise be dedicated to addressing students' individual needs.

Theoretical Framework: Transactional Distance Theory

In recent years, institutions of higher education have actively sought to expand their course offerings through ODeL (Falloon 2011). Typically, these ODeL programmes leverage asynchronous communication systems to deliver course content effectively. Prominent online platforms such as Moodle, Google Classroom, and MyVista are instrumental in facilitating distance learning. According to Falloon (2011), distance learning provides significant advantages to students by affording them the flexibility and autonomy to determine how, when, and where they engage with their studies. Research has underscored the importance of regular interaction—whether between teacher and student, among peers, or with course content—within the realm of distance education. This study aimed to establish the viability of preparing mathematics educators and students who are adept in teaching and learning practices, respectively, thereby enhancing mathematics proficiency at all educational levels through the implementation of modularisation. Consequently, this study aimed to synthesise Moore's (1997) key propositions regarding the theory of transactional distance in relation to the modularisation framework in higher education. This investigation, therefore, examined the feasibility and implications of modularisation on learning mathematics as it is informed by Moore's transactional distance theory.

Moore's Transactional Distance Theory

Moore's theoretical oeuvre regarding transactional distance elucidates the communication gaps that can arise in the teaching and learning process, which are often attributed to the spatial separation between educators and students. According to Moore (1997), three critical factors must be addressed to bridge the gap of transactional distance: dialogue, structure, and student autonomy. Dialogue encompasses all forms of communication among students, their instructors, and the educational content, ultimately leading to the resolution of students' challenges (Giossos et al. 2009). Moore (1997) underscores the significance of the quality of dialogue, positing that its effectiveness in addressing students' learning difficulties and facilitating knowledge creation outweighs the mere quantity of communication. In a high-quality dialogue, both students and instructors actively engage in the co-construction of meaningful learning experiences (Moore 1997). This suggests that assignments and regular feedback can serve as integral components of such dialogue.

Moore's second factor pertains to the structure of a course, which encompasses both its rigidity and flexibility. This structure refers to the extent to which the goals and objectives of the course are clearly defined and prescribed. It also considers the pedagogical approaches employed in teaching the subject, the nature of course assessments, and the instructor's ability to tailor instruction to meet individual student needs. Proficient instructors are therefore expected to leverage their expertise to adapt teaching materials and methodologies in order to authentically represent the mathematical content in honest and conduct effective instruction. This implies that educators are acquainted with the knowledge of strategies that enhance students' critical thinking and learning processes.

Moore's third factor involves student autonomy, which is typically influenced by the course dialogue and structure. Student autonomy is closely related to a student's sense of self-direction or self-determination. In this context, the student exhibits self-motivation, initiating their own learning processes. The student is capable of identifying personal goals and objectives for their study, as well as selecting specific problems to investigate. The course design must be sufficiently flexible to allow the student to determine the pace, sequence, and methods for gathering information (Giossos et al. 2009). Consequently, students can analyse, reason, and articulate ideas effectively while solving or interpreting mathematical problems across various contexts (Ojose 2011). Autonomy empowers students to formulate, apply, and interpret mathematical concepts in diverse contexts (Edo et al. 2013). Nonetheless, an important inquiry arises: How can this autonomy be effectively achieved within a modularised framework?

Moore's theory is particularly pertinent to this study as it provides a lens for assessing the value and feasibility of modularisation in ODeL in the context of mathematics. This assessment is informed by Moore's factors of dialogue, structure, and autonomy, which are essential to fostering knowledge development in this discipline. In essence, this study investigated the possibility of modularisation for mathematics ODeL students, utilising Moore's transactional distance theory of learning as a measurement tool. Thus, the ideas presented by Moore offer a theoretical foundation that facilitates the interpretation of participants' responses into distinct themes. The primary objective of this study was to examine educators' and students' perceptions of modularisation and its viability for their ODeL learning experience, specifically in terms of the three key factors: relationship formation, knowledge development, and the communication of information. These factors align closely with Moore's (1997) dimensions, which include quality dialogue (student engagement and information dissemination), structure (the formation of relationships), and autonomy (knowledge development). The findings of this study may significantly contribute to broader university decision-making regarding the implementation of modularisation within its ODeL courses. Moreover, the results may enhance the synoptic understanding of the modular system and its role in improving learners' experiences in ODeL environments. This study aimed to establish the feasibility of modularisation in teaching and learning mathematics through ODeL by assessing the perceptions of both students and lecturers concerning how viable modularisation is, the implication of the modular system on the communication and relationship formation in mathematics, the impact of modularisation on mathematics knowledge development, and by identifying the factors that influence student engagement with modularisation and the manner in which they operate.

Methodology

This study employed a qualitative case study design, as this approach facilitates an in-depth investigation of real-life phenomena within their natural contexts (Creswell 2015). The selection of the case study method was particularly pertinent, as it enabled the researchers to analyse data comprehensively within a specific setting. The focus of this research was on the undergraduate Bachelor of Mathematics Education programme, with particular interest in the newly introduced modular teaching and learning model. The sample consisted of five lecturers and 20 students, purposefully selected based on their experiences with the modularisation approach. Data pertinent to the study were collected through semi-structured interviews with both students and their educators. The primary focus of these interviews was to explore the participants' experiences and perceptions regarding the implementation of the modularisation system. This exploration aimed to assess the feasibility of the model in the context of teaching and learning mathematics. Mathematics is conceptualised in three dimensions: the content of mathematics, the processes involved in teaching and learning mathematics, and the contexts in which mathematics is applied (Vincent-Lancrin et al. 2019). Accordingly, students provided responses focusing on their reported learning experiences concerning mathematics content and the methodologies of mathematics instruction utilising the modularisation approach. The data collected were subsequently transcribed, coded, and analysed through thematic analysis. According to Nowell et al. (2017), thematic analysis is a method that enables the identification, organisation, description, and documentation of themes that arise within a dataset. The themes emerging from the analysis were centred on relationship formation, knowledge development, and the communication of information in mathematics, and these findings were discussed in relation to Moore's theory of transactional distance.

Findings and Discussion

This study identified that while the modular model of learning and teaching is a prudent approach, it is not without its limitations. Among these limitations are restricted time, depleted resources to facilitate its effective implementation, and a lack of expertise among the participants, all of which adversely affect students' mathematical proficiency. One undergraduate participant, Syds, expressed concerns when asked to articulate the merits and demerits of this educational system:

> The time is not enough for other university-wide modules. … Sometimes it will be difficult when you need to cover a lot of work over a short period without anyone helping you. Tutorials are not done at college, its ODeL.

The issue of time is of paramount importance, as adequate time is essential for students to grasp mathematical concepts effectively (Spitzer 2022). Another undergraduate in the field of mathematics, Solos, echoed this sentiment, emphasising the necessity of sufficient time for comprehension.

> Disadvantages include limited time for in-depth understanding. Limited time also raises challenges in integrating concepts across different courses.

Solos articulated that the constraints of time hinder the understanding of mathematical concepts. This viewpoint aligns with Spitzer's (2021) assertion that mathematics needs more time if proficiency is to be improved. According to the National Council for Curriculum and Assessment (NCCA 2014), mathematics becomes more comprehensible and coherent when it is integrated with other domains of learning. This perspective is consistent with Solos's emphasis on the importance of incorporating mathematical concepts across various courses.

According to Moore's (1997) transactional distance theory, it is essential for students to have the opportunity to formulate, employ, and interpret mathematical concepts across various contexts. The practice of inundating students with large amounts of information at once can cripple their critical thinking and creativity, ultimately diminishing their mathematical autonomy. Additionally, when students are unable to establish their own goals and objectives or to determine the sequence of their learning because of time constraints, their ability to develop mathematical knowledge may be seriously impaired.

Regarding the resources, the lack of adequate support, particularly in terms of Wi-Fi connectivity—a critical factor in the successful implementation of ODel—poses a significant challenge. Resources serve as the foundational element during the introduction of any new programme. One student, Chicks, articulated concerns regarding the availability of these essential resources:

> If you don't have a modern phone or laptop to store all the reading material, modularisation will be a challenge. … There are network challenges for reading online as well as sending the assignments via email.

Chicks's observations align with the findings of Dejene's (2023) study, which identified the challenges associated with teaching and learning mathematics in online courses as stemming from insufficient resources. Chicks emphasised the need to address instances where educators request hard copy submissions for assignments. Although the model was designed for distance learning, many educators continue to adhere to traditional teaching methods, which undermines the objectives of ODeL. The requirement for hard copies necessitates printing and in-person submission, a process that is both time-consuming and potentially conflicts with the modular system's intent. This indicates a lack of understanding of the new educational approach and supports Mapfumo's (2022) assertion that educators encounter difficulties in implementing the modular system. Moreover, the inability to access essential resources such as Wi-Fi, smartphones, and computers correlates with inadequate interaction between students and content or instructors, as posited by Moore's theory. Effective dialogue, in which both students and instructors actively engage in the learning process, is crucial for fostering constructive educational experiences (Moore 1997). Insufficient communication between students and educators, exacerbated by resource limitations, can hinder the establishment of a sound relationship formulation between the learners and their educators. When both parties struggle to connect, the learning process is significantly obstructed. Accordingly, Moore (1997) underscores the criticality of dialogue quality in addressing students' learning challenges and facilitating knowledge creation.

Some participants expressed a positive view of the modularisation system, as it engages them fully and fosters concentration on their academic studies, leaving little time for relaxation before subsequent examinations. Student Syds indicated that the consistent pressure of having regular examinations and managing substantial workloads within a limited timeframe enhances their problem-solving abilities. Consequently, Syds asserted that this approach contributes significantly to their academic development:

> I have seen that the modular system is good because it helps students to cover a lot of work over a short period of time. This system has improved my problem solving skills, critical thinking skills, and critical consciousness skills.

While Syds acknowledges the advantage of operating under the pressure of limited time, Fauns expressed concerns. Here is her statement:

> The pressure is too much and there is not enough preparation for the modules …, you just read to pass the examinations.

The sentiments expressed indicate that both students are primarily focused on passing their examinations. Learning mathematics solely with the aim of passing these assessments undermines the objectives of STEM education within higher learning institutions. This situation in modularisation suggests that the limited timeframe available encourages students to memorise concepts rather than develop a comprehensive understanding. Furthermore, Syds articulated the benefits of the modular system as follows:

> You will write the examinations whilst you will be remembering what you have learnt, unlike at the end of the semester. … Once we get the study materials from the lecturers and tutorial tasks, we are home and dry, we know we will make it in the exam.

Syds's remarks are a clear reflection of rote learning, where students focus on memorising concepts without achieving true comprehension. Syds's observations indicate that memorisation often takes precedence over and transcends genuine understanding among the students. Scholars such as Rodeiro and Nadas (2005) contend that administering examinations shortly after instruction can reveal several shortcomings and misconceptions. By and large, the students' remarks suggest a tendency to adopt a superficial, reproductive approach to learning, primarily aimed at passing examinations, rather than developing a profound conceptual grasp of the subject matter. This situation may lead to difficulties in applying theoretical knowledge to practical scenarios. Rodeiro and Nadas (2005) further assert that the brief duration of each course limits students' opportunities to realise their full potential. The fundamental objective of studying and learning should be to comprehend and retain knowledge for future application. Therefore, if knowledge is merely retained for the purpose of examinations and is subsequently discarded soon after being recorded on paper, the true purpose of learning is fundamentally undermined. According to Prayekti et al. (2020), learning is defined as the capacity to construct individual mental models in mathematics, which aligns with Moore's concept of autonomy within the transactional distance theory. Failure to make sense out of mathematics independently is likely to result in students learning the bulky of their mathematics in a vacuum, with little attention given to some sort of mathematical application. This situation indicates that the limited timeframe inherent in a modularised system restricts flexibility in the teaching and learning of mathematics. The course structure (study material, tutorial tasks, and then examination) is so rigid that the educators are left with no other option of delivering information to the students except teaching to the test. Consequently, this approach could diminish the opportunities for personalised or individualised learning tailored to the specific needs of students, which contradicts the structural framework outlined in Moore's (1997) theory of transactional distance.

Syds expressed appreciation for the tutorial tasks assigned by their lecturers in preparation for examinations, noting that, without these tasks, the examination process becomes quite cumbersome. According to several lecturers who participated in this study, these tutorial assignments closely resemble the format of the subsequent examinations for the respective modules. Consequently, students tend to concentrate primarily on these tasks to achieve favourable examination outcomes. The entire system appears to be predominantly oriented towards the objective of passing examinations with improved grades. Lecturer 1 remarked,

> The issue with this system is that you never rest. Its assignment after assignment, marking and giving feedback before the students write their examinations. Examinations need to be marked and recorded. Before you even start thinking about resting, another block starts with another course. It's a continuous process but eish, we are human beings and professionals at the same time, we need a social life, we need to rest, we need to research. However, we give students tutorial tasks that they should work on in order to pass the examinations, otherwise their performance will be dismal in the examination. We make sure the tutorial tasks are similar to the examination. Yes, you can't help it because if they all fail, the lecturer is required to write a report explaining why. But the fundamental question here is whether those grades actually reflect the students' true performance and understanding.

Lecturer 1 raised several sensitive issues regarding the educational environment under the modularisation model. The implications of his remarks suggest that assessment takes precedence over teaching throughout the course, primarily to ensure student success. In addition, educators are often preoccupied with preparing examination materials and grading, which results in an increased workload for both lecturers and students. This heightened workload can lead to elevated levels of stress and anxiety, which Hodgson and Spours (2001) identify as contributing to a diminished social life. According to Hodgson and Spours, a robust social life can enhance mood and alleviate stress; thus, reduced opportunities for social interaction may exacerbate symptoms of depression by heightening feelings of anxiety. Such anxiety can impede daily functioning and negatively affect an individual's engagement, potentially leading to higher student dropout rates and increased attrition in faculties at institutions of higher learning. The sentiments expressed by Lecturer 1 imply that excessive pressure and constrained time may compel educators to adopt a teaching approach focused solely on examination preparation, a phenomenon that Makuvire and Mhishi (2024, 130) describe as cultivating "a climate of memorising." Although continuous feedback is essential in helping instructors identify students' needs (Mutendi and Makamure 2019), the current context, in which the lecturer provides feedback shortly before examinations, indicates that students are primarily receiving feedback for examination readiness. This approach risks undermining the fundamental objective of learning. This assertion was corroborated by students interviewed shortly before their mathematics examination. When asked about the learning strategies employed by their group in advance of the examination, some students expressed discontent with the lecturer responsible for the course, highlighting the distress surrounding the imminent examination. One student, Lily, remarked,

> We need our feedback for assignment 2 so that we may have better insight during our preparation for the examination tomorrow.

Chuk supported Lily, and exclaimed:

> Feedback for assignment 2 should come to help us in the examination.

While it is commendable and warranted that students required feedback for assignment 2, it became evident that they were utilising this feedback primarily for examination preparation rather than for the advancement of their knowledge in mathematics. Moore (1997) asserts that the development of knowledge is fundamentally dependent on the course structure, which encompasses pedagogical approaches that encourage critical thinking and foster effective dialogue, thereby facilitating meaningful feedback.

Solos expressed concerns regarding the pressures associated with the modular mode of learning. He emphasised his dissatisfaction with this approach, despite achieving exemplary results in his examinations. Solos struggles to grasp the underlying concepts owing to the limited time allocated to the module prior to the examination. As a result, he resorts to memorising the concepts, notes, and tutorial assignments provided by the lecturers solely to succeed in the examinations. Accordingly, he articulates his perspective on the matter:

> I don’t like the modular system because it puts a lot of pressure on me to focus on examinations instead of truly understanding the concepts in my courses. This makes it difficult for me to fully engage with the material. The system encourages memorisation rather than deep comprehension, and the limited time for each module and constant examination preparation prevent me from fully engaging with the subjects. Additionally, the system’s fragmented structure makes it hard for me to connect and apply concepts across different courses, which affects my overall learning experience.

Solos expressed a critical perspective concerning the current educational system. He first suggests that the system encourages rote memorisation rather than meaningful learning. Furthermore, this approach to education effectively isolates mathematics from other courses, resulting in its being taught as a standalone discipline due to time constraints. Consequently, the overarching emphasis appears to take the view that the results of the assignments and examinations take precedence over understanding mathematical concepts and that high scores are synonymous with genuine understanding. When knowledge is retained solely for the purpose of passing examinations and is subsequently forgotten, the learning of mathematics becomes significantly impaired.

In response to inquiries regarding the comparison between the conventional and ODeL models of learning, in relation to modularisation, the majority of student participants expressed a preference for the conventional model. They indicated that modularisation aligns more effectively with the conventional learning environment, as it facilitates face-to-face interactions with instructors to clarify course-related issues, a feature that is largely absent in the ODeL model. Although the ODeL model offers benefits such as flexibility and personalised learning, some students, expressed concerns about the limited time available within the modularisation framework. This limitation is further compounded by a lack of direct engagement with instructors. Nevertheless, Cathy acknowledged the advantages of face-to-face modularisation, particularly its provision of easier access to campus resources, thereby fostering greater opportunities for collaboration among students. Both student and lecturer perspectives converged on the observation that ODeL learners predominantly study with a focus on examination preparation. Lecturers often structure their instruction around topics that are likely to appear in examinations to address this trend; otherwise, there is a risk that students may not succeed academically. Data collected suggested that students primarily concentrate on examinable content rather than comprehensively understanding the underlying concepts. Chicks articulated this sentiment, highlighting the need for a more in-depth engagement with the material:

> Though the system promotes attentiveness and concentration, the system, unlike semesterisation, does not give students enough time to study and understand the materials learnt. Once written and a pass grade is obtained, there is no time to look back at the grey areas of that module.

All the lecturers, when invited to share their perspectives and perceptions regarding the modular system, unanimously acknowledged that the system encompasses the ongoing preparation of study materials, examination materials, assignments, and feedback. Lecturer 3 stated,

> Our students don't do anything. If you don't give them study materials, if you set an examination from the study materials, with similar questions that have not been tested before, then you know that passing for them is a dream. … So, when designing an examination based on the study materials, it is advisable to incorporate questions that closely resemble previously tested content.

The remarks presented suggest that the lecturers require additional training in the implementation of the modular system. This system is designed to foster autonomy among students; however, the opposite effect appears to be occurring, as students are receiving information in a manner akin to spoon-feeding. The feedback reflects a predominantly instructor-centred learning environment, characterised by a one-way communication process in which the lecturer provides study materials while students humbly receive them, awaiting memorisation. The construction of knowledge has predominantly relied on the lecturer, who engages in research and disseminates materials to students. Furthermore, the assignments given by lecturers have tended to resemble continuous testing rather than genuine continuous assessment. Consequently, the instructional framework diverges from Moore's theory of dialogue, which emphasises a two-way interaction as essential for meaningful learning to occur.

Overall, while the concept of modularisation is generally prudent, this study indicates that the modular system may, in certain instances, inhibit innovation in mathematics. This outcome contradicts the objectives of Education 5.0, which is the focus of instruction in higher learning in Zimbabwe. Instituted by the Ministry of Higher and Tertiary Education, Science and Technology Development (MHTESTD), Education 5.0

seeks to cultivate graduates who exhibit innovativeness and are prepared for industrial environments. If the structure of the course undermines knowledge development, then the prospect of effective learning may remain elusive. Furthermore, the modular system may produce individuals who are predominantly examination-oriented, with minimal substantive learning occurring due to the continuous assessment model, which divides knowledge into "bite-sized" components, ultimately resulting in abbreviated modes of knowledge delivery.

Implications of the Modular System

The process of preparing for examinations can position students within a vertical mathematisation framework, where emphasis is placed predominantly on procedural fluency in solving mathematical problems, often at the expense of deep comprehension. This situation reflects a failure on the part of both students and educators to cultivate mathematics proficiency effectively. Such circumstances represent a significant issue pertaining to dysfunctionality in mathematics (Clements and Sarama 2013). Additionally, insufficient time allocation may hinder the integration of an inquiry-based approach in the teaching and learning of mathematics, which represents a potential obstacle to the advancement of mathematics proficiency.

Conclusion

While ODeL modularisation presents advantages such as flexibility and personalised learning, its limited time allocation, compounded by the absence of face-to-face interaction with instructors, can negatively impact mathematics learning, particularly in the area of conceptual understanding. This study indicates that the system may inadvertently foster rote learning owing to the insufficient time dedicated to achieving comprehensive understanding.

Second, the study revealed that this mode of learning separates mathematics from other academic disciplines, resulting in mathematics being taught in isolation as a distinct subject. This phenomenon is attributed to limited instructional time and inadequate implementation strategies.

Third, the modular system has the potential to produce individuals who are primarily examination oriented, thereby resulting in minimal actual learning. This is because of the continuous assessments being conducted in fragmented segments, leading to a compressed approach to knowledge delivery.

Fourth, the study identified that the modular system is likely to hinder innovation in mathematics, which stands in opposition to the objectives of Education 5.0. Education 5.0 emphasises the importance of innovativeness in higher learning in Zimbabwe, yet the prevalent reliance of modularisation on continuous testing rooted in memorisation can undermine these educational goals.

In conclusion, while the theoretical merits of a modular system are acknowledged, its implementation appears to be misunderstood by both students and faculty. The researcher highlights a concern that modular learning could potentially produce students who possess superficial understanding and inadequate mastery of mathematical concepts. This issue may arise unless educational institutions make significant investments in equipping their staff with the necessary training to effectively implement this learning approach. Without proper guidance and support, the richness of students' mathematical education might be compromised, leaving them with gaps in their knowledge and essential learning skills.

Furthermore, the mathematics courses taught through the modular approach are often perceived as a collection of disjointed units rather than as an integrated body of knowledge in which each unit interrelates and enhances the others. Achieving this integration requires that assessments for related modules be scheduled concurrently to foster coherence in learning.

Recommendations

According to the findings of this study, modularisation is particularly suitable for traditional learning environments, where students engage in face-to-face interactions with their instructors, thereby facilitating the clarification of specific mathematical concepts. Furthermore, deficiencies in the development of mathematical knowledge, student engagement, dialogue with educators, student autonomy, or course structure—as articulated in Moore's theory of transactional distance, are not inherent characteristics nor are they permanent traits. These factors are not an innate predisposition; rather, they can be induced, cultivated, and addressed effectively, as noted by Barnes (2005). Consequently, the current educational systems and methodologies should be re-evaluated and redirected to align more closely with the needs of learners and the objectives of the institution, particularly in alignment with the principles of Education 5.0. The accompanying diagram illustrates how modularisation can be employed to induce and enhance mathematical understanding, foster relationship building, and increase student engagement through the framework of Moore's (1997) theory of transactional distance.

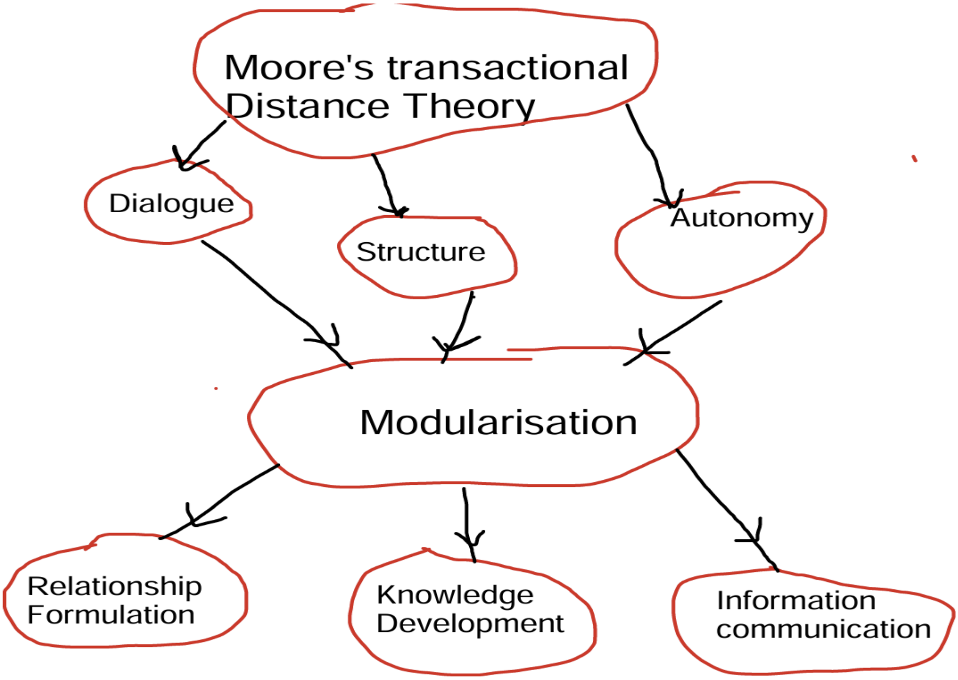

Figure 1: Mathematics knowledge development through modularisation based on Moore's (1997) theory of transaction distance

Figure 1 indicates that the three factors identified in Moore's transactional distance theory, when rigorously applied, may enhance the implementation of a modular approach to learning. Consequently, the effective application of this modular methodology in mathematics instruction has the potential to promote meaningful student engagement and foster knowledge development in mathematics.

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