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Student-Centred Approaches: Translating Theory into Practice by Science Teachers in Malawi Secondary Schools' Context

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Abstract

For some time, student-centred approaches in secondary schools have been advocated for the teaching and learning of mathematics and science in Malawi. It, however, became formal for all subjects after the 2015 curriculum review. Adopting an outcome-based education (OBE) curriculum in secondary education necessitated its implementation through student-centred learning approaches. Since the formalization of the instructional strategy, not much is known about how science teachers effectively implement student-centred teaching in their lessons. This study aims to determine the extent of student-centred teaching implementation in science classrooms as teachers translate theory into practice. Secondary schools were randomly sampled in the Central West Education Division, and the school management identified the teachers to participate in the study. Data was collected through document analysis, lesson observation, and interviews. Seven different science lessons in Biology, Physics, and Chemistry, taught by seven different science teachers, were observed in various schools in Malawi. The study has found that implementing student-centred learning is still challenging due to teachers' varied conceptualization of the construct, unavailability of adequate resources, and teacher capacity-related issues such as knowledge and skills. This affects attainment levels of the curriculum objectives, consequently challenging the achievement of national goals, as highlighted in Malawi Vision 2063, which is grounded in sustainable development goals in the long term.

How to Cite

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INTRODUCTION

Student-centred teaching is not a new phenomenon. Notable works by theorists such as Dewey, Piaget, and Vygotsky have influenced its conceptualization (Thampinathan, 2022; Lattimer, 2015). Literature shows that in modern times, it has a long implementation history, especially in the West. Student-centred learning is therefore understood as an approach where the focus of instruction moves from the teacher to the learners (Babayev Javid, 2024; Du Plessis, 2020). It is a departure from the traditional teacher-centred approach that emphasizes the teacher to what they teach, to learners in a learner-centred classroom, and what they learn (ibid). Depending on the levels of understudy, student-centred learning is also referred to as child-centred learning at the lower levels and student-centred at higher levels. However, the most encompassing is learner-centred, which is popularly used in the middle and lower levels of schooling (Chung & Walsh, 2000).

Student-centred Education (SCE) has been termed a 'travelling policy' due to its endorsement by many international agencies, national governments, and local innovators worldwide. More precisely, it is because of its basis in cognitive psychology and the potential evidence it has to improve processes and outcomes (Schweisfurth, 2013). In Africa, particularly in Sub-Saharan Africa, the past three decades have seen the massive adoption and implementation of student-centred pedagogies in primary and secondary schools with the encouragement of international donor agencies (Lattimer, 2015a).

According to Schweisfurth (2013), three significant justificatory narratives used by theorists, policymakers, and international agencies to advance the SCE in developing countries are highlighted. The first is cognitive narrative, which theorists, with support from cognitive psychology, allude to as the foundation knowledge from which the learners build up meaningful patterns that constitute effective and sustainable learning. Constructivists such as Vygotsky and Bruner understood learning from this angle and underlined the orientation as crucial for the engagement of students and the process of learning itself. The second narrative is emancipation, by which pedagogy is seen to be another way learners can develop the knowledge, skills, attitudes, and behaviours that have long-lasting transformation effects on society. Theorists such as Dewey and Freire are said to be proponents of this cause. In their narrative, education is potentially taken to serve the freedoms of the individuals, and the pedagogy will help to develop knowledge, skills, attitudes, and behaviours that would eventually transform society. The narration also empowers students to exercise their capacity to critique any received knowledge that may be brought into their society. The third narrative is the preparation narrative, which has been invoked in many countries due to its relevance to economic policies. According to OECD (1996), the future of economies without a manufacturing industry depends on this narrative, as cited by Schweisfurth (2013). Knowledge economies are widely considered in OECD countries.

However, implementing SCL in many developing countries has encountered many challenges (Lattimer, 2015b; Schweisfurth, 2011). Among other factors, inadequate resources for teaching and learning, high student-staff ratio, lack of student interest, inexperienced teachers' lack of teaching methodological skills, poor teacher training, and pressure due to high-stakes exams against reforms focus (Abay & Marishane, 2023; Adnyani et al., 2021).

Malawi adopted learner-centred education pedagogies, which are based on social constructivism in the primary school sector in 2007 when the curriculum was reformed to Outcome-Based Education (OBE) from the traditional objective teacher-centred curriculum (Akiba & LeTendre, 2018; Ministry of Education, 2009; Mizrachi et al., 2010). Eight years later (the number of years for the primary school cycle), the secondary school curriculum was revised to align it with the primary curriculum, necessitating student-centred approaches in the secondary sector to achieve the curriculum objectives of outcome-based education. Therefore, this study aims to explore teachers' practices and effective implementation of these instructional approaches to guarantee Malawi's attainment of the goals for its adoption. OBE curriculum implementation primarily emphasizes using student-centred learning (SCL) approaches as it focuses on measuring students' performance through outcomes such as knowledge, skills, and attitudes (Japee & Preeti Oza, n.d.; Katawazai, 2021; Ministry of Education, 2017). Sakata (2022, p.9) argues that in the context of pedagogical research, students, teachers, schools, and policymakers may perceive and interpret the same phenomenon distinctively; hence, the focus is to understand precisely what is happening in the teaching and learning process from the teachers' context and their perception.

To achieve the purpose of the study, the following objectives were set to guide the research:

1 To establish how science teachers plan for teaching and learning concerning the revised curriculum implementation guidelines.
2 To understand how science teachers use specific strategies and practices to implement student-centred learning in the classroom.

To respond to these objectives, the study attempted to find solutions to the following questions:

1 What specific teaching strategies do teachers use to teach science in the observed lessons?
2 What encompasses the teacher's plan for teaching a science subject through a student-centred approach?
3 What teaching practices dominate the student-centred learning classroom for observed science lessons?

Literature Review

Student-centred learning focuses all the attention on the student's learning process, as the teacher observes what and how the students learn and supervises the conditions under which the students learn (Babayev, 2024; CEI-HKUST, 2023). This contrasts with teacher-centred, where the spotlight is on the teacher. One of the potentials of this approach is that students accept the responsibility for their learning and are motivated to ensure that they oversee their learning. This, in turn, reforms the teachers' and students' responsibility in class as students focus on their needs, abilities, interests, and learning styles, leaving the teacher facilitating the learning process (Babayev, 2024).

Theoretical Framework

This study is grounded in constructivist learning theory, establishing the research's theoretical framework. Lev Vygotsky, John Dewey and Jean Piaget are the three theorists most commonly known to have postulated the number of ideas that constitute the learning theory, especially social constructivism. Some theorists also known to have contributed essential postulates of the theory include Bruner, Freire, Montessori, and Plato.

Student-centred learning is based on the constructivist approach to learning involving both social and individual processes in active cognitive processing, which is adaptive and more subjective than objective (Misra, 2021). The theory suggests that knowledge evolves through social negotiation and evaluation of individual understanding (Misra, 2021). Misra argues that there are likely high opportunities for acquiring new knowledge where two or more people converse. Du Plessis (2020) suggests that teachers should provide opportunities for students to construct their knowledge from their experiences and be attentive to their cognition throughout the teaching and learning process (Prawat, 1992, p367). The fundamental premise of this theory is that knowledge is a human construction and the student is an active participant in the learning process (Calderhead et al., 2012, p.19; Misra, 2021).

The constructivist theory also suggests that knowledge resides in the mind rather than externally. Therefore, student-centred teaching methods should be contextualized to enable students to construct knowledge rather than obtain it. The learning experiences that students will undergo will enable them to hypothesize and draw some knowledge. Students should be allowed to make predictions and test their hypotheses about the learning phenomena. However, the theorists (Vygotsky and Bruner) emphasize the role of the teacher, language, and instruction in the learning process. Keiler (2018) argues that teachers' roles should comply with student-centred learning instead of teacher-centred learning. His study found that many teachers struggled to transition from what they are used to as a "content identity expert" to a "learning manager identity." Brush (2000, p.80) has stressed the need for teachers' skills to successfully implement SCL besides resources that are different from those primarily used in traditional teacher-centred classroom activities. In a PERC Program, teachers appeared to be lost during students' activities, such as group work, although the program made strides in promoting student-centred learning (Keiler, 2018). Literature has shown that the teachers' role is one of the three critical areas in successfully implementing SCL, besides the students themselves and the environment. In this study, teachers' roles are understood as their practices in the classroom, and wherever possible, their way of thinking about themselves defines their identities and classroom roles (Beijaard et al., 2004; Keiler, 2018).

Reflection is also considered an essential part of learning; students should be placed in situations where their prior conceptions are challenged. This situation will encourage them to reconsider constructing new knowledge (Du Plessis, 2020). Asking students thoughtful, open-ended, and follow-up questions will enable them to be critical thinkers and engage in further inquiry. This challenge enables them to stretch their

thinking and develop them to be innovators.

According to the constructivist approach, learning is impossible in a truly passive person as each learner structures their knowledge of the world in a unique pattern that connects facts, experiences, and understanding.

Conceptualizing Student-Centred Learning

Student-centred learning involves students being exposed to different learning activities through different teaching methods, learning styles, and assessment techniques to monitor their learning. Even though the focus is on the student's learning and not the teacher, the master planner is the teacher. They are well placed to know the students' abilities, the content to be taught, and the context in which teaching and learning will occur, which should be considered before the students and the teacher come to class. A student-centred approach gives students a choice in what and how to study as individuals (Green & Harrington, 2020). Student-centred learning, therefore, could be one of those approaches that highly focuses on students' needs, abilities, interests, and learning styles, with the teacher as a facilitator of learning (Babayev, 2024). Some critical features have to be evident in a student-centred lesson.

Theorists' Efforts to Share the Conceptual Understanding of the Student-centred Learning Approach

Despite the long history of using student-centred learning construct, different people have understood the construct differently (Mtika & Gates, 2010; Mwadzaangati et al., 2022; Starkey, 2019). This entails that SCL's success in different contexts was also conceptualized differently. Guthrie (2011, 2018) describes student-centred education as not in absolute contrast to teacher-centred education but pedagogical practices in a continuum between learner-centred and teacher-centred. Five styles have explicitly fallen within more to less teacher-centred, authoritarian to democratic teaching practices (Guthrie, 2018).

Neumann (2013) proposed a different framework to conceptualize student-centred learning. He realized that other players use the construct as they understand it, getting different outcomes. In the framework, student-centred learning is divided into three contours: the learning context that centres in students as "in", the context that centres on students as "on"; and the context that centres with students as "with."

Starkey (2017) discusses student-centred learning as having three dimensions that are student cognitive development, which focuses on each child's learning progress; developing agency, which involves empowering students to have a sense of belonging and control; and humanist which includes knowledge of one's aspirations, interests, and personalities and developing learning relationships.

Schweisfurth (2013) also proposed minimum standards for a student-centred education that can be used to illuminate whether the teaching and learning taking place in a particular context could be described as either student-centred learning or not. The seven points that touched base with lesson engaging learners, the fair atmosphere between teacher and students, critical use of prerequisite knowledge to progress with learning, use of dialogue as opposed to transmission, the relevance of the curriculum to student's needs, the basis of the curriculum concerning skills, attitude, and content, the position of assessment in this learning opportunity.

Bremner (2021) proposed ten aspects of guidelines to describe student-centred learning, which was summarized into six aspects, as some points were contained within the other aspects. These were identified following a meta-analysis of 326 journal articles regarding what student-centred education might entail. The analysis singles out the following aspects to be critical in a lesson that follows a student-centred approach, as depicted in Table 1.

Table 1. Bremner's six aspects of describing student-centred education

No	A 6-aspect framework for defining SCE
1	Active participation (including interaction
2	Relevant skills (real-life and higher-order skills)
3	Adaption to needs (including human needs)
4	Power sharing
5	Autonomy (including metacognition)
6	Formative assessment

Some identified challenges in implementing student-centred learning. Studies have revealed many instances where student-centred learning approaches have not performed as expected. In Indonesia, on teachers' problems in implementing student-centred learning, Adnyani et al. (2021) found three primary sources of challenges: those that emanate from students, teachers, and learning facilities. Students' abilities, passiveness, and lack of effort in their learning derailed the smooth implementation of student-centred learning. Students were found to be not motivated to pursue project-based learning,

hence no autonomy in their learning. Teachers lacked the expertise to manage student-centred learning; for instance, they could not group the students heterogeneously to promote cooperative learning. Teachers' inability to provide consultations adequately when students are conducting projects due to large class sizes also affected the implementation of student-centred learning. The lack and inadequacy of some vital teaching and learning materials compromised the use of the approach, leading to the failure of implementing student-centred learning approaches.

In Nepal, a study to determine the perceptions and practices of secondary school teachers and students towards student-centred education found that teachers' inability to deliver through a student-centred approach, crowded classrooms, lack of parental support, and the state of physical facilities were significant challenges for successful implementation (Shah, 2020). In a related study in Malawi on student teachers' experience, Mtika and Gate (2010) found that the initial preparation of student-teachers for using student-centred learning during their training was inadequate to enable them to use it competently. In the US, teachers' feeling of irrelevance in class, from content expert to learning manager, made them feel like sharing more information and doing more than the students during the learning period (Keiler, 2018, p.13). This evidence of teachers' inability to assume new roles competently in a student-centred learning approach in the classroom. In Ethiopia, teachers failed to deliver through the approach even though found it to be instrumental for students' learning as it proved more beneficial than traditional teacher-centred teaching approach (Abay & Marishane, 2023; Chidubem & Adewunmi, 2020; Fufa et al., 2023).

METHOD

This study was executed through a qualitative approach. The qualitative approach allowed for the examination of the teaching practices that entail whether the instructional strategies used by the teacher in the classroom promote student-centred learning in teaching science or not. The research approach was opted for due to the flexibility of the design, which allowed in-depth exploration of the problem being studied, as suggested by Creswell (2012). He further attests that the data collection and analysis framework is better defined by the quality of the research design proposed. A case study design was chosen so that a defined group of participants could be used in this study to determine what practice may be appropriate for the entire population. The decision for such designs also depends on the priorities given to the study's dimensions. Bromley (1986) describes a case study as an in-depth, detailed examination of a particular case within a real-world context. So, the choice of research design impacts any research being carried out. Ethical clearance was granted by Southwest University, the Faculty of Education Ethics Committee, and the Ministry of Education in Malawi authorized data collection.

Participants Demographic Information

This research was carried out in the Central West Education Division (one of the six administrative areas for the secondary school section in Malawi). The division is divided into six education districts, the administrative units for the primary school sector. However, at the division level, they use them to demarcate areas within the division. Participants for the classroom lesson observation and interviews were randomly chosen from three districts out of the seven due to logistical challenges. The school chose teachers while the sampling was towards the school, considered the basic unit for curriculum implementation. Seven teachers participated in the study. Table 2 shows the participants' data below using pseudo names for both schools and participants.

Table 2. Participants' information

	Mk	Male	Gal	Levi	Kwali	Mari	Mate
School	1	2	3	4	5	6	7
Gender							
Male	☺			☺	☺		
Female		☺	☺			☺	☺
Age range							
25-29 years							
30-39 years		☺		☺	☺	☺	☺
40-49 years	☺		☺				
50-59 years							
Qualificat							
Dip. Ed							
B.Ed	☺	☺	☺	☺	☺	☺	☺
M.Ed							
Experien							
1-2 years					☺		
3-5 years		☺					
6-10 years				☺		☺	☺
11-15 years	☺		☺				
16-20 years							
20 + years							

Data Collection

The following three methods were used to collect data that steered this study toward finding solutions to set study questions: document analysis, classroom observations, and post-lesson interviews with teachers whose lessons were observed.

Tools

A classroom lesson observation checklist

was developed to guide the observation. The instrument had twenty-seven (27) items, which were adapted from two main instruments, TALIS-OECD (2009) and MoEST (2008). It had six (6) categories based on Bremner's Six Aspects Framework (2021). As such, it was checking the following in the course of the lesson: active participation of learners (including interaction); adaptation to needs (including human needs); relevant skills (real-life and higher order skills); power sharing; autonomy of students (including metacognition); and formative assessment. Experts from two countries (China and Malawi) validated the instrument. A semi-structured interview was guided by an interview guide developed to solicit teachers' ideas based on gaps that the classroom observation checklist would not collect from the lessons. The questions were also checked and validated by experts.

Classroom Lesson Observation Protocol

Before the commencement of lesson observation, the participants were informed of the purpose of the study and why it was necessary to observe the lesson as part of the data for this study. Using the Ethical Consent Form, every point was explained and consented to by signing to allow the research events to proceed with mutual understanding. In this study, lesson observation was very critical because the actual use of teaching methods that accommodate a student-centred approach was demonstrated. Zohrabi (2013, p.257) and Creswell (2012) ascertain the necessity of lesson observations to be the first-hand provider of facts. Lesson observation was guided by the use of the lesson observation tool designated for this study.

Different lessons varied in length; some were single periods (35-40 minutes), while others were double periods (70-80 minutes). The variation in duration for the period goes with schools that operate on a double shift basis (designated to increase access) and those that operate typically. The lessons were recorded wherever possible, either through audio or video, and transcribed. All schools' post-lesson discussions or interviews were conducted immediately after lesson observation and five months after the lesson was taught to complement the participants' actions against their lesson planning.

Interview

The interview was incorporated into the study so that participants could explain their planning and any necessary changes undertaken in the teaching and learning process, which is 'actual practice.' It was also designed to draw the participants' understanding of student-centeredness so that their actions could be well understood as they guided the lesson.

Document Analysis

Some essential documents, such as the Secondary School Curriculum and Assessment Review (SSCAR) Framework, schemes of work, and lesson plans, were analyzed to understand the participants' practice as they executed their services, especially the observed lesson. Through the SSCAR Framework, the government's intent to urge teachers to use student-centred approaches was spelled for implementing the curriculum even though the document did not go beyond that.

Then, the schemes of work revealed how teachers prepare to teach science to their assigned classes, along with some vital information for the kind of students they have. This is where the anticipated student-centred methods were stipulated. The lesson plan was the teacher's evidence of how the lesson would flow. It had the steps to be taken in the actual process of teaching and learning, where some of the methods proposed in the schemes of work were implemented. Therefore, it must be analyzed to understand the teacher's thinking process before implementing a student-centred learning experience.

RESULT AND DISCUSSION

Result

Q1: What specific teaching strategies do teachers use for teaching science in the observed lessons?

The document analysis process provided enriched outcomes to respond to this question. The document analysis revealed more about the policy direction toward implementing SSCAR and the emphasis the curriculum has placed on using student-centred approaches.

Concerning policy direction, the SSCAR Framework was quite detailed in that SCL approaches have chosen straightforward methods for assessing and evaluating student performance based on outcomes such as knowledge, skills, and attitudes (Ministry of Education, Malawi, 2015, p8). The PCAR report indicated that reforms were necessitated by, among others, the need to make education relevant and responsive to the needs of Malawians (Ministry of Education & UNICEF, 2007, p.2), so these two pieces of information were complementary.

Analysis of schemes of work revealed the dominant teaching methods teachers frequently

use. In this study's interest, only those planned to be used in the week of lesson observation were recorded (Table 3).

Table 3. Planned teaching methods as captured in schemes of work of the observed teachers

Teacher, level, and subject	T/L and assessment methods planned
Teacher 1: Senior Biology	Q and A, Discussion, Explanation, Oral and written exercises
Teacher 2: Junior Physics	Experimentation, Brainstorming Discussion, Q&A, Group work, Demonstration, Explanation
Teacher 3: Senior Biology	Explanation, Group work, Presentations, Oral questions
Teacher 4: Junior Chemistry	Q and A, Group work, Demonstrations
Teacher 5: Junior Chemistry	Group work, Explanation, Observation, Roleplay
Teacher 6: Junior Chemistry	Experimentation Discussion, Explanation, Q&A, Demonstration Group work, Brainstorming, Written exercises Reading assignment, Observation
Teacher 7: Junior Chemistry	Explanation, Group work, Q and A

The table illustrates that the following methods were dominant and planned mainly by teachers for their subsequent lessons regardless of the nature of the lesson: explanation, group work, and question and answer.

A practical student-centred lesson starts with thorough preparation. Prawat (1992) points out two essential issues a teacher should bear in mind when planning for SCL: that is consideration of guesses for student thinking in the planning process and individual interpretation of various contextual variables, which is vital for students to express their ideas during instruction willingly; otherwise, if students feel to be at risk when volunteering opinions, they withdraw their participation from classroom discourse.

All lesson plans accessed for the study were not as detailed as expected. This was regardless of the nature of the template, which is generally acceptable in all public schools. Some presumed information on the plans was unavailable, for instance, a reflection of teaching methods designated for the intended lesson. Teachers' anticipated reactions by students in an SCL class were possible measures that can be undertaken either to enhance learning or correct misconceptions that were not reflected in all plans.

This was the case besides the expectation that in Malawi, the lesson plan should show some basic information such as student characteristics, success criteria, selection of appropriate teaching, learning, and assessment resources, and selection of appropriate teaching, learning, and assessment methods as these informs the individual teacher on what lesson materials should be prepared for a specific lesson. When the lesson plan has essential information for learners, it also considers the context besides the content and procedures. Teachers are mindful of when to challenge the students' thinking and when to be supportive to make progress in their learning.

Q2: What encompasses the teachers' planning for teaching a science subject through a student-centred teaching approach?

According to Clark and Peterson (1986), the teaching process is too complex, and two domains help to discuss the process that's teachers' thought process and teachers' action and their observable effects. Fang (1996) concurs that teachers' thought processes occur inside teachers' heads and are unobservable. On the other hand, teachers' action domains include teacher behaviour, student behaviour, and student achievement scores that are readily measurable.

Behind this background, interviews were employed to tap into teachers' thought domain and understand their planning for student-centred learning. Teachers demonstrated that factors that relate to the choice of teaching methods, the abilities of students, and teaching and learning resources available in the school matter a lot and determine the course of their planning. Areas such as knowledge of curricula and the student's learning process based on previous or subsequent lessons were not featured in their thought processes. Table 4 shows overviewof planning decisions and some examples of participant quotes.

Table 4. Overview of planning decisions and some quotes by participants

Domain	Sub-theme	Example of quotes from the participants
Determination to plan for student-centered teaching	Choice of teaching methods	…so, you need to plan the work, know the content, materials, and methods that will work according to your concepts.
	Ability of students	Sometimes, I also consider the nature of the students that I have. I know other students have problems understanding me correctly, so I consider how I will present to them so they understand.
	Availability of teaching resources	I consider the materials first if they are available because I need to give them to learners search information. These are textbooks, and on my side, I do not depend on one textbook. There are several of them.
	Class size and environment	I consider the number of students in the class; if the class is too big, then as a teacher, I prepare enough for all the students and even consider the space or the room to be used.
	Time allowed on the timetable	I also consider the time allocated for the lesson. Is it a single period or double period so that the activities planned should tally with the time that is allocated

From this perspective, it was understood how the lessons were planned based on the policy directive that the revised curriculum is implemented through SCL approaches. Teachers play a significant role in determining the course of action students should follow in learning. To successfully implement the revised curriculum, teachers are critical regarding the proper choice of teaching and learning methods for the expected outcomes.

Q3: What are dominant teaching practices for observed science lessons student-centred learning classroom?

Teachers' teaching practices in the classroom include activities initiated by the teacher to promote learning among the learners. Outcomes from the lesson observation guide and the transcribed lesson answered this question. These two helped to understand the teachers' teaching practices better. The lesson observation guide was constructed based on student-oriented practices in line with Bremner's aspects for describing a student-centred lesson. The six aspects depicted in Bremner's student-centred framework and their associated circumstances helped observe the teachers' teaching practices toward implementing student-centred learning.

Active participation (including interaction)

By actively participating students in the lesson, the aim was to check the quality of engagement of students in lesson activities throughout the learning period in either hands-on or mind-on activities. In all the observed lessons, teachers actively engaged students in the lesson in different activities such as group work, whole class demonstration, and whole class instruction by question and answer. In a few circumstances, teachers were observed using brainstorming, where students were stimulated in the thinking process. The group work discussion method, for instance, was used by many teachers to engage students in the process. However, group management and outcomes did not support the students' learning. For instance, teacher at school 2:

> *"So, I want you to go into your groups, be in groups of at least…. I think you should utilize the same old groups. So, we can be in groups of about four, maximum, minimum three. Can you describe some of advantages of using machines in your group? Can you discuss advantages of using machines? So, you will choose someone to report. Make sure you record something somewhere."*

This activity ended with a teacher inviting student representatives of the groups who presented. Without even opening up for other group members to react, the teacher curtailed the class activity with the teacher's summary. That limited the power of social constructivist theory, as what was discussed in small groups had no impact on the entire class. Two teachers used the demonstration method, teacher 2 and teacher 6. Here is how they approached the concept:

> *"So, here I have some examples of machines. And some of these, some of them, you have already mentioned here. So, we have a bottle opener in the group of simple machines. This one. It is easier to open those soft drinks using a bottle opener, right? Yeah, then using teeth. You end up losing one. Another simple machine is scissors. We also have a knife. And this one is used in cutting when you are binding something. So, this is simple. So, it makes the work easier to do. Somebody said, "Nail cutters are also examples of simple machines." So, according to your books, these machines are categorized into three."*

Even though the teacher had all the samples of the simple machines that she would use to engage the students to further the lesson by themselves, for instance, categorizing the machines depending on the observable features to lead to the order of levers, the teacher continued explaining these categories and reduced the learners to mere spectators. According to Bremner (2021), there was no autonomy and relevance attached to their learning, though the teacher initiated it in her explanation.

In this second scenario, teacher 6 confessed that the method she used here was a demonstration, even though, to an observer, it looked like a different strategy altogether.

> *"Today, we are going to look at categories of bases. We have at least three categories of bases. Does anyone have an idea? (a minute pause) These are Metal hydroxides, Metal oxides, and Metal carbonates."*

The teacher 6 continued by asking students to give examples of metals that form those bases, and the lesson continued. In all circumstances, the opportunities were not used to seriously engage the students, stimulate their thinking, and enable them to further their learning through independent thinking. Secondly, teacher's strategy does not meet the expectations of an effective demonstration. This demonstrates the teacher's deficiency in pedagogical content knowledge to use the intended strategy, hence using non-allied teaching practices.

Table 5. Description of categories of guidance used during teaching

Teachers' guidance	Methods used	Description
GD	Group work, Pair work	Students discuss specific problem or question (posed by teacher) group
WI-Q&A	Question and Answer Explanation Demonstration	The teacher asks closed questions, usually yes/ no questions or questions with correct answers, to direct students' thinking toward the desired conclusion.
WD	Brainstorming, Discussion,	The teacher poses how and why questions to class and encourages students share ideas.
WI	Lecture	Teacher's monologue to introduce the scientific concepts or share experiences related to the topics

To confirm students' level of involvement in the lesson, the methods used were categorized based on their ability to engage students in social interaction during the lesson and to what extent. The methods used were therefore classified depending on teachers' activities guidance during teaching and involvement of students as follows: Whole-Class Instruction (WI), Whole-Class Instruction – Question and Answer (WI-Q&A), Whole-Class Discussion (WD), and Group Discussion (GD) (Fang, 2020). Table 5 shows the description of these classes.

Relevant skills (real-life and higher-order skills)

This refers to the meaningfulness of content in students' lives. A reflection of how the students were involved in the teaching and learning process to attain 21st century skills such as analysis, critical thinking, creativity, and lifelong learning. Of the seven lessons observed, it was clear in other lessons that a teacher could ask students to relate what they are learning to what is happening in everyday life and discuss the essence. For instance:

To confirm the students' comprehension of endocrine and exocrine systems as different groups presented that the pancreas belongs to either of the two systems, he posed this analytical question:

> *"Why is the pancreas both an exocrine and endocrine?"* Teacher 1-Biology

To ensure the student's application of the concept of machine, the teacher wanted to know how the students could explain what is demonstrated in this activity:

> *"…if you have ever observed in an institution, the cleaners who clean the surroundings use brooms with long handles. Do you know why? Have you ever tried that at home?"* Teacher 2-Physics

In a lesson where students were learning about excretion, the teacher asked a question for the students to reflect on their body systems on how they get rid of wastes:

> *"Why do people urinate more frequently during the cold season and occasionally during the hot season?"* Teacher 3-Biology

This question shows the relevance and rate of excretion given different conditions and how the body responds. As a precautionary measure, students ought to propose a rate of fluid intake with seasonal changes for healthy living.

Adapting to needs (including human needs)

This aspect considers the abilities of students on entry, such as prerequisite knowledge,

skills, and experiences that can be of interest and used to continue learning in the subsequent lesson. It was evident in all lessons observed that the teacher could start with a recap of the previous lesson to ensure students' prerequisite knowledge of the current lesson. However, even after a swift introduction, most lessons could not promote students' independent learning.

Power sharing

This is when the students are involved in decision-making and dialogue with peers and teachers. Traditional power distances between teachers and students are reduced, and teachers' and students' opinions are valued during learning. There is no single correct answer in the SCL lesson. Observations showed that power sharing was exercised to some extent in all lessons observed, though with varied degrees. In the Biology lesson, for instance, the teacher allowed students to develop learning materials used during class discussions. They were free to share their ideas while learning. These students could decide on issues that impacted their learning as the teacher guided them during the learning session.

Autonomy (including metacognition)

This was when students were expected to take responsibility for their learning-by-learning content and develop their lifelong 'learning to learn' (metacognition). Teachers were expected to create an atmosphere that would allow students to experience this.

In a biology class, teacher 1 also used group discussion, and this is how he introduced it to his students:

> *"I think two minutes will be enough. In those groups of four, I just want you to brainstorm and share the information if you have any ideas. I hope you have ideas on the types of glands and their examples"*

Likewise, teacher 1 ensured that the number of students per group was reasonable to allow maximum interaction among group members. Observations showed that students took the activity seriously, as there was a high level of collaboration among students even though the teacher presented it as a mere brainstorming activity. The presentations of the students' discussion outcomes were fundamental for the lesson's progress.

A chemistry lesson by teacher 4 also incorporated a group discussion strategy. He randomly assigned numbers to all students from 1 to 5, signifying five groups in a class where students were over 55. The researcher's physical counting of three groups at random established that all had a membership of 12 students each. Then, the teacher went to all groups to distribute cards for the activity. This is how he engaged the students:

> *"I have given you pieces of paper containing different formulas, such as molecular and structural formulas of some examples of organic compounds. Using those papers, classify the compounds into two main categories: hydrocarbons and Oxy-hydrocarbons. Do that exercise as a group. Is it clear?"*

The teacher 3, for instance, used whole class instruction and whole class instruction Q&A for eighty (80) minutes. The class was actively involved in questions and answers; the lesson employed an explanation method with less interaction among the students themselves. Even her questions were more choral, meaning individual learners were not catered for, a departure from student-centred learning where individual progress and outcome are central. Whole class instruction, question and answer, helps to guide students towards the achievement of specific learning outcomes. The instructional methods are instrumental when setting the scene or motivating students to engage in learning; otherwise, they are limited in students' collaboration, which is crucial for constructivist learning. So, all observed lessons limited students' autonomy to learn by themselves. Students were not allowed to plan and implement activities by themselves that lay the foundation for lifelong learning. Every action by students emanated from the teacher's initiative and guidance.

Formative assessment

In all lessons observed, teachers posed questions to check whether students were learning so that they could be further supported. Sometimes, formative assessment activities such as exercises and assignments were assigned at the end of the lesson to confirm students' understanding of the concepts taught. In a chemistry lesson, a teacher asked students to briefly state what they had learned, while some asked for clarification where necessary.

Discussion

Results show that science teachers in Malawi prepare for their prospective lessons as it was observed that all seven teachers had their lesson plans readily available. However, the quality of preparation for lessons does not benefit student-centred learning. Prawat (1992) points out two critical issues a teacher should consider when preparing for student-centred teaching: (1). Consider conjectures for student thinking in the plan-

ning process, and (2). Individual interpretation of various contextual variables is critical for students to express their ideas willingly during instruction; otherwise, if students feel at risk when volunteering opinions, they withdraw from participating in classroom discourse. A typical lesson plan depicts a detailed execution plan for the intended lesson regardless of the nature of the template. It even contains information on the methods designated for the intended lesson. Literature suggests that a constructivist lesson plan should provide a suitable period of equilibrium and disequilibrium. Time should be allowed for students to contemplate things in their minds and then try alternatives to disagree and reflect.

Sketchy lesson plans that teachers develop for their lessons only show what a teacher will initiate and what the students will do, which is a sign of surface preparation. Most activities were limited to initiating but could be better if they also demonstrated expected outcomes that may transpire from the students' activities. SCL is just an approach, but a teacher must go beyond what is expected so that they can guide the learning well. Chiphiko (2014) found out with primary school teachers that inadequate planning was due to a lack of pedagogic knowledge, which cannot be ruled out in this study. There is no distinction in the levels of preparation between an ordinary lesson and a constructivist-based lesson.

Document analysis also revealed that science teachers are limited in their choices of teaching methods that promote student-centred learning among the students. Those methods create more room for students to share their thinking and be able to co-create knowledge. Lesson observations demonstrated that all teachers involved their students to some extent in their lessons. However, the involvement was limited in answering questions posed by teachers. Very few instances where teachers engaged students in critical thinking and promoted the students' creativity. Although group discussions and pair work could be used to attain lesson success criteria, the level of collaboration was not high enough to develop the 21st-century skills that student-centred learning is popularly known for (Fufa et al., 2023). Teachers made attempts to engage active learning in their approach rather than SCL. Misra (2021) cites Brame (2016) to define active learning as:

> Activities that students do to construct knowledge and understanding. The activities vary but require students to do higher-order thinking. Although not always explicitly noted, metacognition—students' thinking about their learning—is essential, providing the link between activity and learning. (p. 1)

Misra (2021) mentioned that the four active learning elements are talking and listening, writing, reading, and reflecting. Most teachers that were observed could engage students in these aspects in passing. Many teachers confuse SCL approaches with active learning styles. Demographic information shows that five of the seven lessons observed were taught by teachers who have been in the system for over six years. Their experiences in teaching have an almost similar life span to the incumbent curriculum. Interviews confirmed that during their initial training as science teachers, they were encouraged to use active learning methods to ensure maximum engagement of their students, which some teachers believe is the same as student-centred learning. This is why most teachers cannot distinguish between active and student-centred learning. According to the constructivist theory that anchors student-centred learning, it was expected that the student's active participation in the learning would enhance the creation of new knowledge through their interaction other than answering yes or no questions throughout the whole lesson where there is no stimulation of students' thinking.

Interview results have shown that giving autonomy to students to pursue their learning leaves teachers with an inferiority complex, posing as if they don't know how to teach, and at the same time, teachers think that students cannot learn anything by themselves. A teacher in PERC Program (Keiler, 2018) also had similar fears, thinking that her learners could not learn anything that had not first come out of her mouth without her guidance. This is a self-mentorship whose primary identity is a content expert in the classroom and whose role is an explainer. Hence, all teachers prioritize explanation as a teaching method. The challenge is that teachers who are rooted in traditional teacher-centred teaching and have their identity and roles grounded in it do not know how to prepare and steer a student-centred lesson. There is confusion in teachers' roles regarding the teacher-centred background and student-centred learning classrooms. Deliberate action to re-orient teachers on the basic framework of SCL and their roles in student-centred teaching may improve the situation.

CONCLUSION

The study aimed to establish precisely how science teachers plan for teaching and students' learning following the revised OBE curriculum

and also understand how those science teachers use specific strategies and practices to implement student-centred learning in the classroom concerning curriculum implementation guidelines.

Document analysis revealed that science teachers are limited in their choice of pedagogical methods that could bring out SCL in their lessons. The lesson plans analyzed showed that teachers' planning was inadequate to conduct SCL lessons fully. It was also established through lesson observation that employing the chosen strategies to demonstrate constructivist theory using the SCL approach was implicitly done. It is high time that teachers understood the underlying theories and appreciated the need to thoroughly prepare and implement student-centred teaching to enhance students' learning. As a travelling policy, SCL's advantages cannot be over-emphasized. Practice should take chances to fully utilize and develop the student's capabilities with relevant skills essential for development. There is a need to support teachers who still think and believe that traditional teaching approaches such as lectures and explanations can deliver 21st century skills (critical thinking and creativity, collaboration, inquiry), which could be acquired passively. The study recommends that the government enhance teachers' support activities through in-service training, classroom supervision, and inspection. Such efforts will help to align teachers' identities and roles with student-centred learning approaches and eliminate teachers' role confusion in classrooms. Many teachers use teacher-centred pedagogies because they think students cannot learn without their explanations. Well-designed in-service training has a high potential to eliminate these challenges and improve revised curriculum implementation, which bears the hope for the country's vision and sustainable development goals to be achieved.

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