Teachers' Understanding of Learning Styles: Perspectives on Curriculum Adaptation in Secondary Schools of Mareko Special Woreda, Central Ethiopia Regional State

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Abstract:

This study examines teachers' understanding of learning styles and their impact on curriculum adaptation and student engagement in secondary schools of Mareko Special Woreda, Central Ethiopia Regional State. The primary purpose is to assess how teachers perceive and identify diverse learning styles, the strategies they employ to adapt curricula accordingly, and the perceived effects of these adaptations on student participation and motivation. Employing a convergent mixed methods design, data were collected through questionnaires and semi-structured interviews. The study targeted all Mathematics and Natural Sciences teachers (a total of 52) across three secondary schools, using census sampling. Purposive sampling was employed to select six teachers for in-depth interviews. Quantitative data were analyzed using descriptive statistics, including frequency and percentage whereas qualitative data were analysed using thematic analysis. Major findings reveal that although teachers possess a moderate to high familiarity with learning styles, their understanding often lacks depth, relying mainly on observational methods rather than systematic assessment. Group work and multimedia resources are the most common curriculum adaptation strategies, but resource limitations and insufficient training hinder broader implementation. Teachers generally perceive curriculum adaptation as significantly enhancing student engagement; however, their capacity to fully realize these benefits is constrained by limited professional development and resource shortages. The study underscores the need for targeted professional training and resource provision to improve teachers' ability for effective curriculum adaptation aligned with diverse learning styles. The study recommends workshops, resource allocation, and the establishment of peer support systems to foster the accommodation of students with diverse learning styles.

Keywords: Learning styles, Curriculum adaptation, Student engagement, Secondary school, Teaching strategies

Introduction

Background of Study

Curriculum adaptation in secondary education has gained increasing importance in Ethiopia amid the nation's commitment to providing inclusive and relevant education that caters to the

diversity of learners' needs. Policy statements explicitly advocate for the adaptation of curricula to meet regional diversities and learners' specific needs, supporting inclusive education objectives (MoE, 2020). This implies that teachers are expected to adapt the curriculum to meet the needs of learners, emphasizing the engagement of learners in the teaching-learning.

Recent studies appear to support that teachers are increasingly expected to adapt their curriculum and tailor resources to suit students' readiness and learning styles. (Geel et al., 2023; Inayat & Ali, 2020; Tomlinson, 2014). Likewise, studies from several educational settings propose that matching teaching strategies with learning styles (such as auditory, visual, kinesthetic, or other) is important in maximizing learning, high engagement with self-regulated learning strategies, and academic achievement. (Dunn & Burke, 2006; Geche, 2009). These findings suggest that adapting curriculum and teaching strategies to align with students' learning styles is crucial for their meaningful engagement and maximizing learning outcomes.

Since learning styles are thought to affect how pupils process and retain knowledge, they have long been seen as an important component of educational theory and practice. Advocates contend that adapting instruction to each student's unique learning styles, including auditory, visual, and kinesthetic styles, can improve academic performance and engagement (Pashler et al., 2008). To provide more individualized and successful learning experiences that can increase motivation and enhance results, educators have integrated learning styles into pedagogical practices (Dunn & Griggs, 2014). Nevertheless, there has been a much criticism directed at the idea of learning styles. The absence of empirical evidence demonstrating the efficacy of teaching pupils in accordance with their preferred approaches is one of the primary problems. According to meta-analyses, learning results are not considerably impacted by adapting teaching strategies to students' preferred learning styles (Pashler et al., 2008). Critics further contend that the classification may result in fixed mindset beliefs that impede students' growth and oversimplify intricate cognitive processes (Dunn & Griggs, 2014). Additionally, placing too much emphasis on learning styles runs the risk of downplaying the significance of diverse teaching strategies that are advantageous to all students. Even though the idea of learning styles has impacted educational practices, new research suggests a more evidence-based strategy that prioritizes a variety of teaching techniques over strict adherence to learning type ideas.

Studies conducted across the African continent on curriculum adaptations indicated that, although teachers are familiar with the concept of adapting curriculum or modifying instructional strategies, they are not implementing it effectively to meet the diverse needs of the learners due to several hindrances (Ako et al., 2019; Nguvava & Meremo, 2021). This suggests that, despite possessing knowledge of instructional methods modifications, teachers do not effectively execute their lessons in ways to meet the diverse needs of the learners; instead, they predominantly rely on one-size-fits-all, traditional teaching strategies. Moreover, local studies conducted by Merawi (2020) and Tadesse (2018) revealed that, despite teachers exhibiting varying levels of understanding of the concept, they face significant limitations in implementing it effectively. Consequently, many teachers continue to teach diverse learners within the same classroom using a 'one-size-fits-all' approach. Likewise, Amare & Dagnew (2020) and Keski-

Mäenpää (2018) researched the implementation of active learning strategies and reported that, despite teachers having positive perceptions of these strategies, their actual practices of active learning were low. Furthermore, historically, teaching and learning in Ethiopian secondary school culture, as well as teachers' thinking, have been characterized largely by a traditional, teacher-centered approach, which often ignores the diverse learning needs of students. (Geleta et al., 2022; Keski-Mäenpää, 2018; Roseman, 2018). This suggests that pedagogical practices in Ethiopian classrooms do not adequately address the diverse learning needs of students

Likewise, another local study was conducted in the Gedeo Zone and Halaba by Ginja (2016) explained that the implementation of active learning in various stages of the teaching process at primary schools was not yet being fully practiced, but is likely promising. The use of active learning, such as group work, pair work, and open-ended questions, is often overlooked in teaching processes. In the context of Mareko Special Woreda, characterized by its multicultural population, diverse backgrounds, and learning styles, strategic geographic location, these challenges and opportunities are particularly salient. This context provides an ideal setting to explore teachers' understanding of learning styles and curriculum adaptation within a relevant and manageable scope, particularly in subjects deemed foundational by the Ethiopian Ministry of Education, namely Mathematics and Natural Sciences (Physics, Chemistry, Biology, and ICT), which are critical for advancing science and technology in the country (MoE, 2020).

Statement of the Problem

Most studies conducted in the Ethiopian context observed the approaches of teaching-learning as teacher-centered or student-centered without adequately accounting for teachers' understanding of diverse learning styles, or how curriculum adaptation is employed as a response to these styles (, Allen, 2022; Keski-Mäenpää, 2018 ; Roseman, 2018). While some national and international studies have observed the understanding of learning styles and teaching strategies (Geleta et al., 2022; Cardino & Ortega, 2020), they have highlighted the mismatch between the learning styles of students and the teaching strategies employed.

Notably, there is a lack of research focusing particularly on the teachers' understanding of learning styles, the curriculum adaptation strategies they use to meet the students' learning styles in the country, and how these are integrated into the recently reformed curricula. The complexity of subjects like Mathematics and Natural Sciences necessitates curriculum adaptations, which heavily rely on teachers' understanding of students' learning styles and their ability to adapt curricula accordingly (MoE, 2020). Secondary schools serve as a critical transition phase where curriculum adaptation significantly impacts student performance and future educational pathways (Merawi, 2020)

Several contextual challenges further complicate curriculum adaptation. Studies in zones such as the Gedeo Zone and Halaba by Ginja (2016) identified obstacles, including large class size, limited time, bulky content to be covered, and a lack of materials. Similarly, research in the Gurage zone's primary schools by Derese et al. (2025) recognized factors like inadequate curriculum support for friendly teaching, curriculum that allows for discussion, and practical

curriculum, which affect student performance, especially among diverse and multicultural student populations like those in Mareko Special Woreda, Central Ethiopia. Additional challenges affecting the effective implementation of active learning strategies in response to diverse students' learning needs included teachers' perception of adapting instruction as time-consuming, limited resources, lack of knowledge, workload, lack of commitment, a high student-teacher ratio, and inadequate leadership support (Amare & Dagnew, 2020 ; Keski-Mäenpää, 2018; Tadesse, 2018). Therefore, this study was initiated to explore strategies that inform curriculum adaptation based on learners' learning styles during the implementation of newly developed curricula in secondary schools of Mareko Special Woreda. The focus is on assessing teachers' understanding of students' learning styles, curriculum adaptation strategies employed, and their impact on students' engagement in secondary schools of *Mareko special woreda*.

Research Questions

a) To what extent do teachers perceive and recognize diverse learners' learning styles?
b) What curriculum adaptation strategies are employed by teachers?
c) What are the teachers' perceived impacts of curriculum adaptation on student engagement?
d) What are the perceived challenges that hinder teachers' effective curriculum adaptation practices?

Significance of the Study

The study provides a foundational understanding that can inform targeted professional development programs to enhance teachers' awareness and responsiveness to individual learner needs. This, in turn, supports the creation of more inclusive classroom environments where instruction is tailored to diverse learning preferences. These insights can influence policy decisions to prioritize adaptive teaching approaches, ultimately fostering higher student motivation, participation, and academic achievement.

Collectively, the study's findings will serve as a vital resource for policymakers, curriculum designers, and teachers by providing evidence-based recommendations for curriculum development and instructional strategies that accommodate diverse learning styles. Moreover, the study establishes a scholarly foundation for further research into effective curriculum adaptation practices in secondary education, particularly in mathematics and natural sciences.

Delimitation of the Study

The study examines teachers' understanding of learning styles, their curriculum adaptation strategies, and the perceived impact on student engagement. As the key aspect of curriculum adaptation, the study delimits its scope to process adaptation rather than exploring other areas such as content, product, and assessment adaptation in curriculum delivery. The research targets Mathematics and Natural Sciences teachers, as these subjects are considered foundational for Ethiopia's national development goals in science and technology. The data were collected from

teachers who actively teach these subjects during the academic year, and questionnaires and interviews were used as data-gathering instruments. Geographically, the scope of this study was confined to three available public secondary schools within Mareko Special Woreda.

Definition of Basic Terms

Learning Styles:- Learning styles are ways in which each learner begins to concentrate on, process, absorb, and retain new and difficult information (Dunn & Burke, 2006).

Curriculum Adaptations: - Curriculum adaptations refer to the modification of instructional methods, strategies, or processes to accommodate the diverse learning styles of students, ensuring meaningful access to the curriculum (Tomlinson, 2014).

Teaching strategies: -Teaching strategies refer to the various methods that teachers use to facilitate learning and engage students. Different teaching styles can influence how effectively students grasp concepts, develop skills, and get motivated (MoE,2020).

Student engagement:- Ginting (2021) defined that student engagement is an active participation in a variety of academic, co-curricular, or school-related activities, as well as a dedication to achieving learning objectives.

Review of Related Literature

Conceptual Framework

Understanding Learning Styles

Learning styles refer to the preferred ways in which individuals perceive, process, and retain information. According to Kharb et al. (2013 and İlçin et al. (2016) learning style is the setting under which a person begins to concentrate on, absorb, process, and retain new information. These styles encompass a range of cognitive, emotional, and environmental factors that influence how learners interact with material and how they best absorb knowledge (Tatarinceva, 2012) The concept suggests that individuals have distinct preferences for receiving information, which can significantly affect their learning experiences and outcomes.

Common models of learning styles include the VARK Model, categorizing learners into four types as visual, auditory, reading/writing, and kinesthetic modalities (Dunn & Burke, 2006). This implies that learning styles are individualized approaches, which can vary significantly from one person to another. Thus, understanding learning styles is vital for teachers as it enables them to create more effective and personalized instructional strategies, thereby enhancing student engagement and achievement (Peace et al., 2024). This suggests that recognizing and accommodating these diverse styles can lead to improved instructional outcomes and a more inclusive learning environment.

Learning styles significantly influence curriculum adaptation by shaping instructional strategies to meet diverse learner preferences. Recognizing that students absorb and process information differently, visual, auditory, kinesthetic, or reading/writing, teachers can modify curricula to

enhance engagement and comprehension. For instance, tailoring activities to accommodate these styles can improve motivation and academic outcomes (Dunn & Griggs, 2014). Research indicates that curriculum adaptation that considers learning styles fosters inclusive education and promotes equal learning opportunities (Dunn & Burke, 2006). However, some scholars argue that overemphasis on learning styles may lack empirical support for improving learning outcomes (Pashler et al., 2008). Despite this debate, integrating awareness of learning preferences remains a valuable component of curriculum development, aiming to personalize learning experiences and optimize student success.

Curriculum Adaptation Strategies

Curriculum adaptation is essential to ensure that educational programs effectively meet the diverse needs of learners. According to Allen (2022), while the curriculum encompasses all learning experiences designed to achieve specific educational objectives, it is essential to acknowledge that the appropriateness of these experiences may vary according to contextual factors. Regarding the factors necessitating curriculum adaptation, Andini et al. (2020) identified aspects such as school and classroom context, student characteristics, needs and learning styles, and teachers' professional competence and characteristics. This highlights the importance of personalized and context-aware education, emphasizing the need for ongoing assessment and interaction among students, teachers, and the broader educational framework.

Since the scope of this study is delimited to process adaptation, particular emphasis was placed on strategies such as tailored instruction, flexible teaching methods, and the incorporation of multiple modalities. Process adaptation involves utilizing a variety of teaching methods, such as direct instruction, cooperative learning, and inquiry-based learning, to present information in ways that align with diverse learning styles. Grouping students based on their learning preferences for specific activities, allowing them to collaborate with peers who share similar styles (Peace et al., 2024; Alabi, 2024).

Understanding the different learning styles further informs these instructional strategies. Agustrianita et al. (2019); Peace et al. (2024) categorize learners into four types: visual, auditory, reading/writing, and kinesthetic learners, each benefiting from distinct approaches. Visual learners prefer images, graphics, posters, and illustrative texts and diagrams. Auditory Learners benefit from listening, debates, and discussions. Reading/Writing learners favor text-based activities, including reading and taking notes. Kinesthetic Learners learn best through hands-on experiences and movement-based activities. To effectively address these diverse styles, curriculum adaptation strategies can be employed, intentionally incorporating strategic diversity in the instructional practices to support all learners effectively.

Student Engagement

Engagement can be seen in various terms, such as student participation, academic participation, student involvement, academic involvement, involvement in school assignments, and involvement (Ali & Hassan, 2018). Student engagement is a multifaceted construct that embodies the degree of attention, curiosity, interest, optimism, and passion that students exhibit

towards their learning processes (Abbagidi, 2022). Moreover, research identified that student engagement is multidimensional, comprising behavioral, emotional, and cognitive components. Behavioral engagement includes students observing community norms and participating in activities. Emotional engagement involves students' feelings of interest, boredom, happiness, sadness, and anxiety. Cognitive engagement is closely related to motivation and refers to the involvement of students' desire and ability to engage in a variety of strategies to self-direct learning (Inayat & Ali, 2020).

Building on this understanding, teachers play a vital role in influencing student engagement by creating opportunities through planned strategies and applying effective learning theory. Therefore, teacher support is important in influencing the engagement of students in academics, which in turn contributes to the success of students in school (Ali & Hassan, 2018). This suggests that when teachers actively implement engaging instructional methods, they can better address the diverse needs of their students and create a more inclusive and motivating learning environment.

However, despite the recognized importance of engagement, challenges in classroom student engagement in schools are multifaceted and can significantly impact learning outcomes. Common issues include diverse student backgrounds and learning styles, which make it difficult to implement active learning strategies (Perry, 2022). Additionally, lack of motivation and behavioral problems, and limited resources further complicate efforts to maintain student attention and involvement (Merawi, 2020). Consequently, addressing these challenges requires innovative instructional methods, personalized learning approaches, and fostering a positive classroom environment to enhance engagement and promote academic success (Raza, 2018).

Impacts of Curriculum Adaptation on Students' Engagement

Teachers' understandings of students' diverse learning styles help them design teaching methods that meet students' diverse learning styles (Agustrianita et al., 2019). Another study conducted by Inayat & Ali (2020) appears to show that it is important to realize that teaching style is central to student engagement; hence, it is vital to have learning opportunities in classrooms by adapting their teaching styles to their students' learning styles, which promotes active engagement and collaborative relationships (Inayat & Ali, 2020). This implies that teachers' effective understanding of learners' learning styles and strategies to tailor their teaching methods to students' learning styles leads to higher levels of student engagement.

Determining learners' learning styles will be a great help to teachers in designing and implementing a particular strategy that suits them (Cardino & Ortega, 2020). Regarding the way to determine learners' learning styles, Agustrianita et al. (2019) suggested that teachers conduct a survey or informal assessment to categorize their students' learning styles. Then, based on the data, they can decide what learning style is the most dominant in a particular class and how many smallest styles are found in the class. In other words, they can provide support for students with similar learning styles, and this will create a more student-centered and comfortable teaching environment. Thus, by understanding the different learning styles, teachers can adapt

teaching strategies to the particularities of the learners that suit their learning styles (Pascu, 2024). Consequently, based on the premise that all learners have the potential to learn effectively if their learning styles are considered, students' motivation and interest in learning increase. Then, students who are interested in learning are more likely to devote time and effort to achieving their goals. As a result, involvement is viewed as a motivator in achieving academic success (Ginting, 2021).

The relationship between learning styles, academic performance, and adequacy of instructional materials has received significant attention in educational research (Cardino & Ortega, 2020). By understanding and considering students' learning styles, instructional materials, and teaching strategies can be adapted to better meet individual learners' needs (Oliveira et al., 2023). This creates a more personalized and engaging learning environment, providing students with greater academic success (Andini et al., 2020). Therefore, schools must create enabling experiences so that students with diverse learning styles experience success in learning and achievement up to their potential. This is only possible if the teachers respond to the specific needs of learners in a classroom through curriculum adaptations (Allen, 2022). Without modifications, some students in the classrooms would never be challenged to perform up to their potential, while others may not be able to experience success (Hatami, 2013). This means that to meet diversity, there is a need for adaptations of the regular curriculum, which may involve organizational modifications in the goals and contents, in the methodologies, the didactical organization, the temporality, and the evaluation philosophy and strategies.

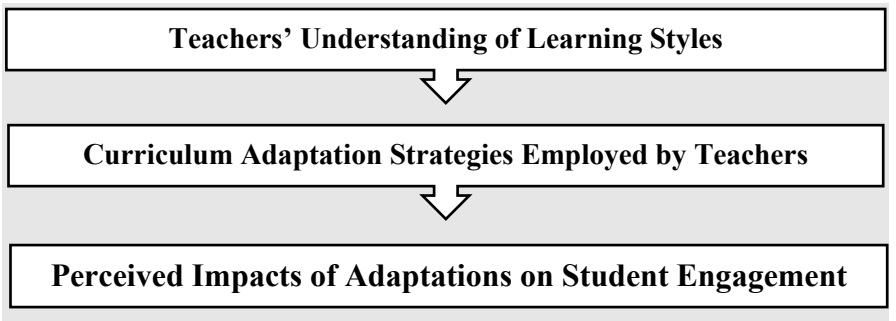

Figure 1. *Visual representations of the interplay among the variables*

Theoretical Framework

Constructivist Learning Theory

Constructivist Learning Theory offers a comprehensive foundation for examining teachers' understanding of learning styles and their influence on curriculum adaptation. Rooted in the philosophy that knowledge is actively constructed by learners through experience and social interaction (Giannoukos, 2024; Harasim, 2018), constructivism emphasizes learner-centered, active, and collaborative learning processes. This perspective aligns well with the research focus, as it underscores the importance of teachers recognizing and accommodating diverse learning styles to foster meaningful and personalized educational experiences.

According to Efgivia et al. (2021) and Giannoukos (2024), the principles of constructivism applied in teaching and learning are: a) Learners build their knowledge by experiencing and engaging with their surroundings. b) Learning involves active and creative processes, not just passively receiving information. c) Learners should be prompted to inquire, associate ideas, and contemplate their learning methods. d) Learning is a collective and cooperative process because learners develop understanding through collaboration. e) Teachers should facilitate by steering learners through learning and supplying chances to explore and uncover. f) Learning should relate to learners' experiences and interests. g) Seek and assess students' opinions. h) Adjusting the curriculum to respond to student perceptions. From this, it can be deduced that constructivism prioritizes active, collaborative, and relevant learning experiences that are responsive to students' needs and perspectives.

Chand (2023) identified four basic characteristics of constructivist learning environments, which must be considered when implementing constructivist instructional strategies: 1) Knowledge will be shared between teachers and students. 2) Teachers and students will share authority. 3) The teacher's role is one of a facilitator or guide. 4) Learning groups will consist of small numbers of heterogeneous students (Olusegun, 2015). Thus, constructivist learning environments prioritize meaningful interactions in the learning process, aiming to prepare students for engaging with complex problems and diverse perspectives beyond the classroom. Constructivism is one of the cornerstones of contextual teaching and learning (CTL) approaches. Constructivists believe that learning is shaped by the context in which an idea is taught, as well as by students' beliefs and attitudes (Harasim, 2018). There are five important elements in a constructivist learning environment, namely: (a) paying attention to and utilizing students' prior knowledge, (b) meaningful learning experiences, (c) a conducive social environment, (d) encouragement so that students can be independent, and (e) there is an effort to introduce students to the scientific world (Efgivia et al., 2021). Integrating these constructivist elements with an awareness of students' learning styles enables teachers to create more personalized and effective learning environments, foster deeper understanding, and lifelong learning skills.

Constraints in the application of learning according to constructivism are: it is difficult to change the beliefs and habits of teachers, teachers are less interested and have difficulty managing constructivism-based learning activities, the teacher's assumption that the use of new methods or approaches in learning will take considerable time, an evaluation system that still emphasizes the final grade, the magnitude of the teacher's teaching burden, students are accustomed to waiting for information from the teacher, and the existence of a negative culture in the student environment (Harasim, 2018). This shows that the adoption of constructivist principles in education faces significant challenges that can impede the effectiveness of this learning approach.

Materials and Methods

Research Method

To achieve the purpose of this study, a mixed-methods approach was employed. A convergent parallel design was used to examine the research problem by integrating both quantitative and qualitative data (Creswell, 2022). Thus, this design enabled the collection of both quantitative and qualitative data simultaneously using both questionnaires and interviews, analyzed them separately, and then integrated the findings in the discussion section (Johnson & Christensen, 2020). This process helps to validate findings through triangulation, enhancing the overall credibility and robustness of the study.

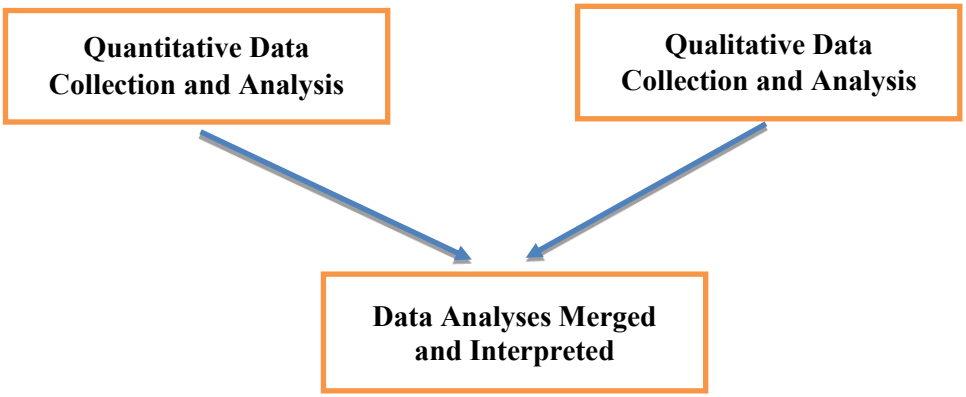

Figure 2: *Process in Convergent parallel Mixed Methods Design (adapted from Creswell, 2022)*

Sample and Sampling Technique

To collect data for this study, the researchers targeted teachers from the Mathematics and Natural Science stream (Mathematics, Physics, Chemistry, Biology, and ICT) within Mareko Special Woreda as respondents. A total of 52 Mathematics and Natural Science stream teachers who had been teaching at the three available government secondary schools in Special Woreda were selected as study participants. Given the manageable size of the teacher population, a census sampling technique was employed for the quantitative phase, whereby all targeted stream teachers in the available secondary schools were included. This approach ensures comprehensive data collection, taking the full range of teachers' perspectives, which enhances the representativeness and strength of the findings for the quantitative analysis.

For the qualitative component, purposive sampling was used to select six teachers (two from each school) for in-depth interviews. The rationale for this targeted selection was to identify participants who could provide rich, detailed insights based on specific criteria, namely, their experience, qualifications, and roles within their respective schools. They participated in both the questionnaire and in-depth interviews to provide a layered understanding of the issues under investigation.

Table 1: The population, Sample, and Sampling Techniques

Subjects	Population	Sample	Sampling Techniques
Secondary Schools	3	3	Census
Mathematics teachers	17	17	Census
Physics teachers	10	10	Census
Chemistry teachers	11	11	Census
Biology teachers	14	14	Census
Total	52	52	Census

Procedures of Data Collection

The collection of the actual data began by contacting the schools' principals in advance. To this end, clear instructions were given to the schools' principals via Zoom Meetings about the study's intention in general and how the questionnaire was to be completed. After a brief discussion with the principals about the objective of the research and the data collection, th made all the necessary arrangements to fill out the questionnaire using Google Forms in their respective schools.

Variables and Measures

- **Understanding Learning Styles:** The extent to which teachers can recognize, understand, and accurately identify students' diverse learning styles, including visual, auditory, kinesthetic, and reading/writing (Agustrianita et al., 2019). This understanding is measured by teachers' self-reported familiarity levels and their ability to accurately classify students' learning styles as evidenced by their responses in questionnaires and interviews (Dunn & Burke, 2006).
- **Curriculum Adaptation Strategies:** The specific methods employed by teachers to align teaching and learning activities with students' diverse learning styles (Allen, 2022). The extent of strategy employment is quantified by teachers' self-reports and observed classroom practices using the frequency and variety of methods used in classroom practice (Peace et al., 2024; Alabi, 2024).
- **Student Engagement:** The active participation, motivation, and behavioral involvement of students during instructional activities, as perceived by teachers (Ali & Hassan, 2018). This is measured through teachers' ratings of student participation levels and interest in learning activities, categorized as high, moderate, or low, based on teachers' observations and responses in questionnaires and interviews (Ginting, 2021).
- **Perceived Impact of Curriculum Adaptation on Student Engagement:** Teachers' subjective assessment of the extent to which curriculum modifications have contributed to increased students' participation and motivation of learners in learning activities (Perry, 2022). This perception is measured through teachers' responses to specific prompts about the effects of curriculum adaptation.

Instruments

As it is convenient to gather vast information from many respondents, both closed-ended and open-ended questionnaires were used to collect data from the teacher respondents. The questionnaire was developed by adapting items from relevant literature, ensuring alignment with the research questions. This approach was chosen to incorporate validated measures while tailoring the instrument to the specific context of the study. The adapted questionnaire was reviewed for content validity and clarity before deployment. Then, it was provided to teacher respondents who had been teaching Mathematics and Natural Science subjects in secondary schools of the Special Woreda.

The researcher employed semi-structured, in-depth interviews as a qualitative data collection method to enrich and contextualize the findings obtained from the questionnaire. The interview guide was developed in English and discussed in Amharic to ensure clarity, cultural appropriateness, and ease of understanding for participants. Before the interviews, participants were briefed on the purpose of the study, confidentiality assurances, and their right to withdraw at any time. The semi-structured format facilitated the capture of rich, nuanced data while maintaining focus on the research questions. The researcher took detailed notes during each interview and, with participants' consent, audio-recorded the sessions to ensure data accuracy and completeness.

Methods of Data Analysis

The information gathered from respondents and informants was analyzed qualitatively and quantitatively to ensure a comprehensive understanding of the data. Quantitative data were analyzed in tabular form using frequency counts and percentage distributions. The scores for each item from the closed-ended questionnaires were systematically organized, statistically compiled, and entered into Excel spreadsheets. Qualitative data derived from semi-structured interviews and open-ended questionnaire items were analyzed through a systematic coding and thematic analysis process. The recordings of the interview discussed in Amharic were transcribed and translated into English, preserving the exact language and expressions used by participants, categorized, and compiled into themes. The results of open-ended questions were summarized and organized into related categories. The results of both qualitatively and quantitatively analyzed data were combined, compared, and interpreted to draw the meanings from the results of the analysis in a combined model.

Validity and Reliability of the Instrument

To gather appropriate data, it was necessary to have reliable and valid data-gathering instruments. Initially, the questionnaire was prepared by the researcher. To enhance content validity, some appropriate and adequate items relevant to the research questions were added to the questionnaire based on the comments provided by my advisor. Then, a pilot test was done

to determine the reliability of the instrument. Questionnaires were administered, and the data were gathered from three secondary schools of *Mareko Special Woreda*. The participants in the pilot study were 9 and 3 from each school. The data was gathered twice from the same respondents within two weeks. Cronbach's alpha was computed using SPSS version 26 for internal consistency and resulted in Cronbach's alpha of .80, which was found to be acceptable as very good. Besides, the pilot revealed that the study questions prepared were seen to be researchable. The procedures tried out to obtain and analyze the data were found to be correct, with a few identified and refined problems.

Ethical Consideration

The researcher had letters of permission from Addis Ababa University for ethical approval, asked for consent from the participants, and did not force anybody to take part in the research. The participants were told that they had the right to withdraw at any time and not to answer or leave the questions they didn't want to ask. The researcher also explained to the participants the purpose of the study and their role in the study. Information obtained from the respondents forms the basis for the research. For the information to be reliable, the respondents should be assured of the confidentiality of the information they provide. Confidentiality was ensured by instructing participants not to include their names on the questionnaire, and all relevant information was communicated to them before data collection

Results

The study investigated teachers' understanding of students' learning styles and their impact on curriculum adaptations and students' engagement. Thus, the study aimed to answer the following research questions: a) How do teachers understand learners' diverse learning styles? b) What curriculum adaptation strategies are employed by teachers? c) What are the teachers' perceived impacts of curriculum adaptation on student engagement? To answer these questions, both quantitative and qualitative data were gathered from teacher respondents and informants. The results of the study are presented as follows, in line with the declarative concepts of each research question.

a) Teachers' Understandings of Students' Learning Styles

This subsection presents both quantitative and qualitative data results to provide a comprehensive understanding of how teachers in Secondary Schools of Mareko Special Woreda, Central Ethiopia, perceive and comprehend learners' diverse learning styles. The integration of data aims to address the core research question: To what extent do teachers perceive and recognize different learners' learning styles?

Quantitative data (Table 4.1) reveals that a substantial proportion of teachers possess at least moderate familiarity with the concept of learning styles, with 57.7% describing themselves as 'moderately familiar' and 40.4% as 'very familiar.' Only a minimum of 1.9% report no familiarity

at all. This suggests that most teachers have at least some awareness of learning styles, which could potentially serve as a foundation for their instructional practices. However, the major category of "moderately familiar" raises questions about the depth of their understanding. The fact that a significant portion of teachers identify as only moderately familiar implies that their conceptual grasp may be superficial, potentially limiting their ability to effectively utilize learning styles in pedagogical strategies.

Table 2: Teachers' familiarity with the concept of learning styles

No	Item	Response Categories	Frequency	Percentage
1	How would you rate your familiarity with the concept of learning styles?	Very familiar	21	40.4
		Moderately familiar	30	57.7
		Not familiar at all	1	1.9
2	What learning styles do you believe are present among your students?	Visual	22	42.3
		Auditory	18	34.6
		Kinesthetic	7	13.5
		Reading/writing	5	9.6

Furthermore, open-ended responses of the questionnaire suggest that while teachers have heard of learning styles, many lack clarity regarding their operationalization. For instance, 19.2% of respondents in their response acknowledged familiarity but expressed uncertainty about how learning styles function in practice, indicating a superficial or incomplete understanding. In addition, 13.5% admitted to having read about learning styles but not fully grasping how to implement them in classroom settings.

The interviews deepen this understanding by highlighting a gap between familiarity and application. Teachers such as T01, T03, T04, and T06 acknowledged the concept of learning styles but expressed limited competence in identifying and addressing them effectively in their teaching practices. For example, T04 commented, *"*I have come across the concept of learning styles, but I don't feel confident in identifying or using them effectively in the practical application of learning styles."

This sentiment reveals a disconnect between theoretical awareness and practical mastery, which is crucial for translating knowledge into effective teaching practices.

Conversely, some teachers demonstrate a more comprehensive understanding. Teacher T05 articulated a nuanced view, emphasizing the importance of recognizing individual differences in information processing: "Learning styles refer to the different ways students process and understand information. For me, it's about recognizing that each student has a unique approach to learning, whether they prefer visual, auditory, or kinesthetic methods".

This response reflects the teacher's deep understanding of the concept of learners' learning styles, highlighting her belief that learning styles involve recognizing that students have individual preferences and that could inform instructional variation to meet diverse learning styles.

In sum, the findings from both quantitative and qualitative data suggest that in Mareko Special Woreda, teachers possess a foundational awareness of learning styles; however, their in-depth understanding and confidence in applying this knowledge remain limited. Addressing this gap is essential to enable teachers to leverage learning styles effectively, ultimately fostering more inclusive and responsive teaching environments.

As shown in Table 4.1 shows the type of learning styles that have been observed among students in classrooms. Accordingly, 42.3% of teachers identify visual learning as prevalent, while 34.6% recognize auditory learning as common among students. In contrast, 13.5% of teachers believe kinesthetic learning is prevalent, and just 9.6% see reading/writing as significantly present. This suggests a significant portion of teachers believe their students predominantly exhibit visual and auditory learning styles, while kinesthetic and reading/writing learners are less common compared to visual and auditory learners. This distribution suggests that teachers tend to prioritize or recognize certain learning styles more readily than others, possibly reflecting their own teaching experiences or the classroom context.

However, the ways or mechanisms teachers used to identify their students' learning styles were raised by both open-ended questionnaires and interviews. Thus, the open-ended questionnaire responses and insights obtained through interviews reveal a relatively contrasting picture of their understanding. Most (80.7%) teachers in their replies to open-ended questions admitted that they had not employed any specific mechanisms to identify students' learning styles and expressed limited knowledge about how to do so effectively, whereas a few (19.3%) of the teachers skipped answering those open-ended questions. Besides, most interviewed teachers (66.7%) (T01, T02, T04, and T05) expressed uncertainty about how to identify different learning styles or integrate this knowledge into lesson planning. Besides, some informants acknowledged that they relied merely on their experiences or observations rather than systematic methods, and they lacked clarity on the mechanisms or criteria for identifying different learning styles.

The convergence of both types of data points to a scenario where teachers' awareness is limited to easily observable styles, predominantly visual and auditory, with minimal engagement in formal assessment. The absence of systematic mechanisms for diagnosing diverse learning styles reflects a pedagogical gap that could hinder effective curriculum adaptation or instructional modifications. Moreover, it raises concerns about the depth of teachers' understanding, as reliance only on informal observations may lead to misidentification or overlooking of other styles such as kinesthetic and reading/writing.

b) Curriculum Adaptation Strategies Employed by Teachers

This subsection presents the findings that offer a comprehensive understanding of the curriculum adaptation strategies predominantly employed by teachers in the secondary schools of Mareko Special Woreda. The results, derived from both questionnaires and interviews, are integrated to address the central research question: What curriculum adaptation strategies are employed by teachers

Table 4.2 confirms the adaptation strategies employed by teachers in their schools in Mareko Special Woreda. Accordingly, group work was the most frequently used approach, with 48.1% of teachers reporting its use. The use of multimedia resources is also a notable trend, with 26.9% of teachers incorporating multimedia in their instruction to make learning experiences more relevant to diverse learners. Hands-on activities appear to be less commonly adopted, with only 15.4% of teachers implementing such strategies. Lastly, individualized instruction was the least preferred, with just 9.6% of teachers reporting its use.

Table 3: Commonly used curriculum adaptation strategies

Statement	Response Category	Frequency	Percentage
Which strategies do you use to adapt the curriculum?	Group work	25	48.1
	Use of MM resources	14	26.9
	Using hands-on activities	8	15.4
	Individualized instruction	5	9.6

Complementing these numerical data, results of qualitative data from open-ended questionnaires and interviews explained their practical realities and constraints faced by teachers. Many teachers highlighted their predominant reliance on group discussions (pair work and small group discussions) with the gapped lectures, aligned with the quantitative findings. However, teachers also expressed limited awareness of alternative or more sophisticated adaptation strategies, citing a lack of training and professional development in individualized instruction and other innovative approaches. Likewise, some interviewed teachers (T02 and T05) expressed difficulty in listing other strategies beyond those mentioned, citing a lack of awareness or training in alternative methods, other constraints such as limited resources and large class sizes, which hinder their capacity to implement or adopt a broader range of adaptation strategies. Regarding this, one respondent cited: "Managing students' differing levels of participation is challenging; some students hesitate to collaborate, and limited resources make it difficult to form groups for effective implementation." The quote underscores the dual challenges of behavioral management and resource limitations that impede the optimal use of collaboration-based adaptation strategies.

In conclusion, the merged data underscores a scenario where teachers are primarily adapting the curriculum through readily available and familiar methods, notably group work, multimedia use

with gapped lectures. However, their potential to diversify these strategies is hindered by insufficient professional development, resource limitations, and classroom management challenges. Addressing these barriers through targeted training, resource provision, and infrastructural improvements could enable teachers to adopt more effective, varied, and inclusive curriculum adaptation strategies, ultimately enhancing student engagement and learning outcomes in Mareko Special Woreda.

c) Perceived Impacts of Curriculum Adaptation on Students' Engagement

The data collected from teachers in the secondary schools of Mareko Special Woreda, Central Ethiopia, offer valuable insights into their perceptions regarding the influence of curriculum adaptation on student engagement. By analyzing data collected through questionnaires and interviews, the study aims to answer the research question: What are the teachers' perceived impacts of curriculum adaptation on student engagement?

Table 4: Teachers' Perceptions of the Effects of Curriculum Adaptation on Student Engagement

No	Statement	Response Category	Frequency	Percentage
1	To what extent do you believe that adapting the curriculum positively impacts student engagement in your classroom?	Very high	17	32.7
		High	24	46.2
		Moderate	11	21.2
		Low	0	0
2	In your experience, how has curriculum adaptation affected student engagement?	Greatly increased	14	26.9
		Somewhat increased	16	30.8
		No change	21	40.4
		Decreased	1	1.9

Table 4.3 presents teachers' perceptions of the effects of curriculum adaptation on student engagement, illustrating a predominantly positive outlook. The majority of respondents (46.2%) of teachers indicated that curriculum adaptation has a "High" impact on engagement, while an additional 32.7% perceived the impact as "Very high." This combined figure of over 79% of respondents reflects a strong consensus among teachers that curriculum adaptation significantly enhances student participation and interest in the classroom. Notably, no respondents regarded the impact as "Low," and only 21.2% perceived it as "Moderate," further underscoring the generally favorable perception of curriculum adaptation's role in fostering engagement. .This trend shows that teachers generally view curriculum adaptation favorably, seeing it as a way to boost students' participation and interest The minimal proportion of teachers indicating a moderate or lower impact suggests limited disbelief about its benefits, further reinforcing the

perceived importance of curriculum flexibility and customization in engaging learners effectively.

Complementing these quantitative findings, open-ended and interview responses revealed that, despite recognizing the positive impacts, teachers face practical challenges in fully realizing these benefits. Notably, gaps in practical skills and resource limitations were frequently cited as barriers to the effective implementation of adapted curricula. These constraints, though not diminishing the perceived value of curriculum adaptation, highlight areas where institutional support and capacity-building are essential to translate positive perceptions into tangible classroom practices.

In summary, the data reflect a predominantly positive perception among teachers regarding curriculum adaptation in enhancing student engagement. While acknowledging existing practical challenges, teachers largely agree that curriculum adaptation is a vital strategy for fostering meaningful student participation. This positive outlook underscores the need for targeted interventions to address resource and skill gaps, thereby maximizing the potential benefits of curriculum adaptation in promoting active student engagement.

The data presented in Table 4.3 reveal valuable insights into the perceived impacts of curriculum adaptation on student engagement from the perspective of teachers' experiences. A combined 57.7% of respondents indicated that curriculum adaptation has either greatly or somewhat increased student engagement, with 26.9% reporting a significant positive effect and 30.8% observing a moderate increase. Conversely, 40.4% of teachers reported no observable change, while a minimal 1.9% perceived a decrease in engagement as a result of curriculum adaptations. This distribution suggests that while a majority of educators perceive curriculum adaptation as beneficial for enhancing student engagement, a substantial proportion perceives no effect, and a very small minority observes a decline.

However, the qualitative insights obtained from open-ended questionnaires illuminate underlying factors influencing these perceptions. Teachers who reported no change or decreased engagement attributed their observations primarily to their limited knowledge and skills in effectively adapting curricula to accommodate diverse learning styles. Similarly, qualitative insights from the interviewed teachers shed light on potential factors underlying successful adaptation of the curriculum to suit learning styles and enhance students' engagement. Specifically, teachers T02, T04, and T05 articulated that their limited knowledge and skills concerning effective curriculum adaptation hindered the realization of potential benefits. For instance, T04 remarked, "Despite my efforts, I feel I lack the strategies to truly engage all students through curriculum adjustment." Furthermore, T02 stated, "Although I am trying to modify the curriculum, I often feel I lack the necessary skills to engage my students effectively. Additionally, a lack of resources, materials, and essential science equipment hinders my ability

to adapt the curriculum to meet students' needs." These statements highlight a critical barrier: teachers' limited capacity and lack of resources to effectively adapt curricula, which consequently impacts student engagement.

On the other hand, the teachers interviewed (T01, T03, and T06) identified that the adaptation of the lessons to accommodate diversified learning styles significantly improves engagement in their classrooms. They added that such adjustments in the curriculum result in an increased involvement in discussions as more students get involved in asking questions, and a sharp increase in interest. This firsthand experience highlights the connection between curriculum adaptation, increased student interest, and the illumination of a previously unexplored area.

Regarding this, one of the Biology teachers (T06) from Udassa Secondary School said:

> *What I have learned at Udassa Secondary School is that sometimes, the meeting of learning styles can make all the difference in the classroom. Sometimes in my lectures, on adding practical experiments or visual aids, students who would otherwise struggle just hearing information alone suddenly become alive: they start contributing, asking profound questions, and sometimes even working with other students to gain further understanding of concepts. This adaptation has brought a great improvement in their understanding of biology and affection toward the subject, which wasn't quite evident earlier.*

These findings confirm that adapting the curriculum to accommodate diverse learning styles enhances students' participation, comprehension, and interest. Teachers' experiences—such as that of T03 from Udassa Secondary School—further demonstrate that employing varied instructional strategies, including practical experiments and visual aids, effectively supports learners who may struggle to keep pace with traditional teaching approaches.

Discussions

The finding of quantitative data indicates that most teachers possess at least moderate familiarity with the concept of learning styles, with 57.7% self-reporting as 'moderately familiar' and 40.4% as 'very familiar' (Table 4.1). This suggests a foundational awareness of teachers on learning styles that align with existing literature emphasizing that awareness of learning styles is a prerequisite for effective, tailored instruction (Oliveira et al., 2023; Dunn & Burke, 2006). However, the dominance of 'moderately familiar' responses indicates that this awareness may often lack depth, potentially constraining teachers' capacity to operationalize learning styles in classroom practice effectively. Furthermore, open-ended responses of the questionnaire suggest that while teachers have heard of learning styles, many lack clarity regarding their operationalization. Regarding the types of learners' learning styles, the findings of quantitative data indicate that visual learning is the most prevalent among secondary schools' students of Mareko Special Woreda, followed by auditory, kinesthetic, and reading/writing styles.

However, the qualitative data complicates this picture, revealing that the majority (80.7%) of respondents in open-ended responses and 66.7% of interviewed teachers admitted to not employing any formal or systematic mechanisms to identify students' learning styles, and expressed uncertainty on how to integrate learning styles into their teaching practices. This discrepancy underscores the limited depth of teachers' understanding, aligning with findings from earlier research indicating that many teachers tend to observe only overt behaviors associated with certain styles, such as visual cues, while neglecting less observable modalities like kinesthetic or reading/writing styles (Oliveira et al., 2023; Allen, 2022). Such reliance on informal assessment methods echoes the literature's assertion that teachers often lack appropriate tools or training for accurate identification, which can lead to misclassification or neglect of diverse learning styles (Dunn & Burke, 2006; Agustrianita et al., 2019).

The findings reveal that teachers in secondary schools in Mareko Special Woreda predominantly employ specific curriculum adaptation strategies, with group work emerging as the most frequently used approach (48.1%), followed multimedia resources (26.9%), hands-on activities (15.4%), and individualized instruction (9.6%) (Table 4.2). These quantitative results are corroborated by qualitative insights, where teachers reported relying mainly on short lectures, small group discussions, and pair work to address diverse learning needs. The prominence of group work aligns with existing literature emphasizing collaborative learning as an effective, inclusive strategy (Inayat & Ali, 2020; Geleta et al., 2022). Teachers reported that group activities facilitate peer learning and cater to different student abilities, though challenges such as resource limitations and student participation issues hinder optimal implementation. Similarly, the use of multimedia resources reflects a trend toward incorporating technology to diversify instructional methods, which has been shown to enhance engagement and accommodate varied learning styles (Giannoukos, 2024; Andini et al., 2020). Hands-on activities and individualized instruction were less frequently employed, likely due to constraints such as limited resources, large class sizes, and insufficient awareness. Moreover, the qualitative data highlighted that many teachers lack awareness or confidence in applying these strategies, consistent with findings by Dunn & Burke (2006), who noted that resource and training deficits impede the adoption of more complex adaptation techniques. Such a view of the authors is supported by Agustrianita et al. (2019) as workshops on individualized instruction and hands-on approaches may better prepare teachers for the curriculum to suit students' diverse learning styles.

The findings of this study reveal a predominantly positive perception among secondary school teachers in Mareko Special Woreda regarding the impact of curriculum adaptation on student engagement. Quantitatively, over 79% of teachers rated the impact as high or very high, indicating a strong consensus that curriculum flexibility enhances students' participation and interest. This positive outlook aligns with the constructivist perspective that individualized, and

contextually relevant curricula foster active participation and motivation (Olusegun, 2015). The positive outlook is further supported by constructivist and multiple intelligences theories, which advocate for learner-centered, personalized instruction responsive to individual learning styles (Giannoukos, 2024). The qualitative responses further underscore that while teachers recognize the positive influence of curriculum adaptation, practical challenges such as limited resources and insufficient skills for effective implementation. However, the gap between positive perceptions and practical application suggests a need for targeted professional development and resource support to bridge skill and resource gaps. Without such support, the full potential of curriculum adaptation to enhance engagement remains unrealized. These barriers echo in the literature, emphasizing the necessity of ongoing professional development and resource support (MoE, 2020; Geel et al., 2023). Moreover, based on the lived experience of teachers, the analysis revealed that teachers predominantly perceive curriculum adaptation as a beneficial strategy for enhancing student engagement, with 57.7% indicating it has either greatly or somewhat increased engagement. This aligns with the theoretical premise that personalized and adapted instruction enhances active participation (Ginting, 2021; Andini et al., 2020). Moreover, from qualitative insights, teachers who reported positive impacts attributed their success in tailoring lessons to diverse learning styles, corroborating the theoretical premise that understanding individual differences fosters deeper engagement (Inayat & Ali, 2020). For instance, teachers who incorporated visual aids and practical experiments observed heightened student participation, validating constructivist principles that active, experiential learning enhances understanding (Giannoukos, 2024).

Conversely, a notable proportion (40.4%) and a minimal share (1.9%) perceived no observable change, and diminished engagement, respectively, citing their limited knowledge, skills, and resources to effectively adapt curricula. This underscores the critical barrier of teachers' professional competence and resource availability, consistent with Efgivia et al. (2021) assertion that curriculum modifications require contextual, tailored approaches, yet without sufficient professional development and resources, teachers may struggle to realize the benefits of curriculum adaptation. and the Ethiopian Ministry of Education's emphasis on ongoing professional development (MoE, 2020).

Conclusion and Recommendations

Conclusion

This study provides a comprehensive understanding of teachers' perceptions, knowledge, and practices regarding students' learning styles, curriculum adaptation strategies, and their perceived impact on student engagement within the context of secondary schools in Mareko Special Woreda, Central Ethiopia. The findings reveal several critical insights that collectively inform both pedagogical practice and policy interventions. Firstly, while most teachers demonstrate at least a moderate level of familiarity with the concept of learning styles,

particularly visual and auditory modalities, the depth of their understanding remains superficial. The discrepancy between awareness and practical application is evident, as a significant majority lack systematic methods for identifying students' diverse learning preferences. This superficial understanding constrains effective curriculum adaptation, potentially limiting the ability to meet individual learning styles and to foster inclusive classroom environments. Secondly, the prevalent reliance on basic and familiar curriculum adaptation strategies, predominantly group work and multimedia-enhanced lectures, reflects teachers' limited repertoire of instructional approaches. Constraints such as resource shortages, large class sizes, and insufficient professional development impede the adoption of more sophisticated and varied strategies like individualized instruction and hands-on activities. This situation underscores the need for targeted capacity-building initiatives and infrastructural support to empower teachers to implement more inclusive and engaging pedagogies. Thirdly, teachers generally perceive curriculum adaptation as having a strongly positive influence on student engagement, aligning with constructivism and multiple intelligences theories that emphasize learner-centered approaches. However, practical challenges, especially limited skills, resources, and institutional support, temper this optimism, resulting in a gap between perceptions and actual classroom practice. Teachers' experiences indicate that without adequate training and resource provision, the potential of curriculum adaptation to enhance active participation and deep learning remains underutilized.

Recommendations

Based on the findings of this study, the following prioritized and actionable recommendations are proposed to enhance teachers' understanding of learning styles, adapt curriculum, and optimize their impact on student engagement:

- Workshops and short-term training sessions focusing on deepening teachers' understanding of learning styles, effective learning styles identification techniques, and practical curriculum adaptation or instructional strategies should be organized by the Mareko Special Woreda Education Office and Secondary Schools (Koshe, Udasa Repie, and Bidara Faka) in the special woreda.

- User-friendly manuals and diagnostic tools, and checklists to support teachers in identifying and utilizing diverse learning styles, had better be offered by the secondary schools and the Education Office of the Special Woreda.

- Allocation of resources by secondary school cluster centers for classroom materials, multimedia equipment, and interventions to facilitate curriculum adaptations and implementation of tailored instructional strategies should be done.

- Schools should establish systems to periodically assess teachers' application of curriculum adaptations based on students' learning styles and their impact on student engagement, providing feedback for continuous improvement.
- Respective departments within the secondary schools in the special woreda should establish teaching communities of practice for sharing successful adaptation strategies, peer mentorship, and ongoing professional dialogue.
- Encourage and support teachers to adopt varied instructional approaches beyond group work and multimedia, including differentiated instruction and experiential learning, through ongoing training and peer collaboration.
- Departments should encourage peer-sharing sessions and collaborative lesson planning that focus on integrating knowledge of learning styles into daily teaching practices, fostering a community of reflective practitioners.

Limitations

Inconsistent internet connectivity hindered some participants from completing online surveys or accessing digital platforms required for data submission. To address this issue, the researcher implemented multiple data collection methods, including offering paper-based questionnaires for participants with unreliable internet access.

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