Adapting Teaching Methods to Accommodate Diverse Learning Styles in Education

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Abstract: In contemporary higher education, teachers must employ diverse teaching strategies to accommodate different student learning styles. The primary teaching methods include lectures, seminars, demonstrations, and tutorials, each serving specific educational purposes. Learning styles are categorized as visual, auditory, kinesthetic, and various social interaction preferences. Teachers are encouraged to tailor their teaching strategies to meet these differences. This review examines recorded lectures using the FILL+ framework developed by Wood et al., exploring how different teaching activities interact with diverse learning styles. It was found that diverse methods, such as interactive lectures, seminars, and group discussions, better foster student engagement and deep learning, particularly in fields like science, medicine, sociology, and physics education. Additionally, the study discusses strategies for accommodating international students and neurodiverse learners, as well as promoting active learning among students of different proficiency levels. In conclusion, employing multiple teaching strategies can better address diverse student needs and improve educational outcomes. Future research could explore the use of technology in personalized instruction and evaluate the long-term impact of diverse teaching strategies on different disciplines and large-scale classrooms.
***Keywords*:** higher education; diverse teaching strategies; learning styles; interactive learning

1. Introduction

A variety of teaching methods employed by educators to cater to the diverse learning styles of students is crucial in contemporary higher education. Wood et al.'s research[1-8] emphasises the urgent need for various educational strategies today. This urgency arises from the recognition that, given the varied learning preferences within any classroom, multiple educational approaches must be utilised to stimulate students' ideas and abilities for active learning and facilitate effective interaction between teachers and learners.

Standard teaching methods encompass lectures, seminars, demonstration courses, and tutorials, each serving a specific educational purpose. For instance, lectures disseminate broad knowledge, while seminars foster analytical discussions. Presentations make knowledge more specific and easily comprehensible for students, and the tutorial can teach students some aspects of the deficiency alone, therefore educators must integrate these approaches to address different learning styles among students and promote their active engagement[1, 4].

The purpose of this review is to analyse recorded teaching courses to examine how different teaching activities interact with different learning styles. Analytical frameworks such as the Lecture Interactive Learning Framework [FILL+], developed by Wood et al. [1, 2] are used to elucidate adaptive measures taken by educators to meet the needs of diverse learners. Through objective and detailed data analysis, conformance or differences between teaching practices and learning styles are identified to gain insights into optimising educational methods that enhance students' ability for active learning and improve their efficiency in acquiring knowledge.

2. Categorization and Understanding of Learning Styles

2.1 Definition and classification of different learning styles

Learning styles are rooted in recognising that people engage with and process educational content in radically different ways. This diversity of learning preferences requires teachers or other educators to take a more nuanced approach and tailor teaching strategies to accommodate these differences effectively. Learning styles can be roughly divided into three main types: visual, auditory, and kinaesthetic. Visual learners use graphics and written materials [diagrams] to understand information. On the other hand, auditory learners succeed in environments that utilise oral instruction and discussion, while kinaesthetic learners thrive in environments that provide hands- on experience and physical contact with the subject matter[9].

On the other hand, learning styles can be described as an individual's preference for social interaction during the

learning process. This classification covers competitive, cooperative, avoidant, participatory, dependent, and independent styles, each reflecting different attitudes toward collaboration and autonomy in the learning

environment. This comprehensive understanding of learning styles can enhance teachers' instructional design and inform the development of assessment methods. Teachers can foster more effective and inclusive learning environments by aligning educational practices with students' diverse learning preferences, ultimately improving educational outcomes [10, 11].

2.2 Cognitive and behavioural theories in learning: Examine how these theories influence student learning

Research has shown that by incorporating cognitive and behavioural theories into educational strategies, teachers can enrich student learning by providing insights into learning and behavioural adaptation mechanisms. Cognitive neuroscience, focusing on relational framework theory, revealshow students adjust their learning behaviour in response to changing environments, distinguishing between habit-based and goal- oriented learning processes. Adaptation emphasizes the interplay between emotional, behavioural, and cognitive aspects and is essential for effective self-regulation in a learning environment. In addition, simulation-based mastery learning demonstrates practical applications of these theories, advocating an integrated approach that combines behavioural, constructivist, and social cognitive principles to facilitate deep learning and practical knowledge application. This synthesis of cognitive and behavioural theories emphasizes the importance of a nuanced, evidence-based approach to education aimed at developing adaptable, engaged, and skilled learners[12-14].

3. Analysis of Teaching Methods

3.1 Traditional and interactive lecture discussions

In Christine Chin's article[7], he explores the contrast between traditional and interactive lecture discussions in science education, describing the shift from a teacher-centred approach to a learning environment with more student involvement. Among them, traditional questioning strategies primarily focus on recall and closed questions, predominantly employed for assessment purposes and can gauge students' existing knowledge. This approach often elicits concise and specific answers, where the teacher maintains control of the conversation and directly rectifies incorrect responses, thereby reinforcing the hierarchical nature of the classroom. In contrast, interactive discussions based on constructivist pedagogy prioritize profound conceptual comprehension and critical thinking through open-ended questioning. This approach encourages students to elaborate on their answers, fostering more inclusive and exploratory conversations. The role of the teacher transitions from an authoritative figure to a facilitator of discussion in which responses are met with neutrality rather than immediate evaluation. This shift transfers assessment authority to the collective student body while promoting a more dynamic and participatory classroom atmosphere. The contrast between the two approaches highlights the evolution of science classroom education strategies, advocating a paradigm that values student engagement, foreshadows higher-order thinking, and fosters knowledge co-creation. It shows that the interactive discussion based on the constructivist teaching method aligns with contemporary educational goals.

3.2 The impact of seminars and demonstration courses on Students' learning efficiency and Effectiveness

The influence of seminar courses on students' learning efficiency and effectiveness is multifaceted. Among them, key factors are active participation, practical application of knowledge, and early involvement in academia. Research has shown that students' understanding and application of knowledge can be enhanced by providing well - structured workshops, explicit preparation materials, and practical guidance methods. In addition, by embedding study skills and health education, a first-year college seminar can increase students' willingness to continue attending the seminar the following year. These findings illustrate the importance of seminar courses to promote academic success and adherence to higher education through targeted content and fostering a good learning environment.[15, 16].

The study " Impact of In-Class Demonstration on Student Performance in an Introductory Thermodynamics Course "[17]shows that classroom presentation can significantly improve students' participation in class, knowledge comprehension, and performance in closed-book assessments. These demonstrations effectively attract students' attention and cultivate students' interest in in-depth learning of specific knowledge. However, the effects of this teaching method are less significant in open - book assessments, suggesting that its effectiveness is primarily in Settings testing immediate knowledge recall and application. This situation shows that the method is effective as an educational strategy, but it depends on the teaching situation at that time.

3.3 The role of teacher questioning in stimulating creative thinking in the science classroom

Teachers' questioning strategies [7]in the science classroom help create an environment where creative thinking develops. Teachers can employ Socratic questioning, linguistic puzzles, semantic tapestries, and frameworks to facilitate students' learning and foster a more profound comprehension of scientific concepts. These strategies also shift students from passive recipients to active participants in learning, encouraging them to explore, promote critical thinking skills, and apply knowledge in novel contexts.

In addition, the importance of teacher-student interaction in enhancing the educational experience is highlighted through interactive participation activities, especially in physics education. This teaching method effectively stimulates students' desire for knowledge and cultivates their necessary ability for scientific inquiry and analysis. By prioritizing these questioning skills, educators can enhance students' creative thinking skills and equip them with the necessary competencies to advance in the sciences. This change of teaching mode to interactive and thought-guided highlights the innovative influence of targeted questioning on the learning methods of science education for middle school students.[2]

3.4 The impact of group discussion on students' learning

Empirical studies across multiple disciplines have shown that group discussions significantly impact student learning outcomes. In medical education[18], group discussions help students understand, retain and apply family medicine principles more deeply than traditional lectures. This approach improves students' cognitive ability and enhances their confidence in learning. Similarly, in social studies education[19], the combination of discussion and lectures improves student performance, showing that the interactive nature of discussion promotes deeper participation in relevant topics. Moreover, in physics education[20], group discussions are incorporated into an interactive learning environment, enabling students to gain insight into complex scientific concepts. These conclusions demonstrate that group discussion can develop students' critical thinking skills, enhance problem-solving skills, and promote dynamic and practical collaborative learning experiences. While group discussion offers multiple benefits in developing critical thinking skills, collaboration, and participation, it is also essential to recognize its possible limitations, such as the potential to deviate from the subject or the dominance of specific individuals that can undermine critical analysis. In addition, students who may be better at expressing ideas and are more introverted may feel marginalized or less willing to participate, which may affect their learning experience. Therefore, balancing these potential limitations requires skilled teacher guidance to ensure fair student participation and practical group discussions.

3.5 Other teaching methods, such as online teaching or student group voting exercises for IS courses

In the wake of the COVID-19 pandemic, higher education institutions worldwide are turning to online teaching. Hence, teachers and other educators must change their teaching strategies and increase "online flexibility"[21]. This concept encapsulates educators' ability to effectively navigate various online teaching situations, driven by the urgent need for educational continuity during lockdowns. This shift also highlights the critical role of adaptability in teaching and learning, as teachers must constantly improve their teaching methods to facilitate communication with students and help students participate in the online classroom. Teachers must be comfortable with the multi-faceted challenges of online education. The advantages of this shift include the opportunity for educators to explore innovative teaching methods and the flexibility and convenience offered by online platforms that can extend the reach beyond the number of students in a class. However, it also exposed some areas for improvement in the implementation, such as difficulty maintaining student engagement, the steep learning curve for teachers and students to effectively utilize online tools, and the need for extensive technical and professional company support in technical and professional development.

In addition, the active learning exercises described in the Information Systems [IS] course[22] involve students voting in groups on current IT and IS topics designed to increase engagement and data literacy. Students actively participate in discussions and deepen their understanding of IS disciplines by assessing relevant articles. This approach enhances students' critical thinking and peer evaluation skills. However, it faces limitations such as ensuring practical peer evaluation and managing the quality of articles. However, even with these obstacles, the approach creates a dynamic learning environment essential for acquiring basic skills in information systems.

4. Analysis of Diverse Student Needs

4.1 International Students

International students face many challenges in overseas university classrooms, including language barriers and acculturation issues, which significantly impact their learning experience and interaction with faculty. For example, because

of the language barrier, international students may worry about making mistakes in expressing their meaning and feel embarrassed easily, which may limit their active participation in class and damage their confidence and willingness to participate in academic discussions. Regarding acculturation, Eastern students are more likely to follow the arrangement of teachers and complete the learning tasks according to the requirements, but this is inconsistent with the active participation and direct communication emphasized in the Western educational environment. To effectively teach and interact with international students, educators should adopt strategies that build student confidence, encourage active participation, and foster an inclusive classroom environment. This includes providing clear and understandable means of communication, providing additional language support resources, and creating opportunities for cross-cultural exchange and mutual understanding.[24, 25]

4.2 Students with different levels of learning

Teachers must combine peer assessment, self-regulation strategies, team learning, and group awareness to effectively manage students with varying prior knowledge and learning efficiency in the classroom. Peer assessment helps to promote closer relationships between students and can also promote students' motivation to learn. Through team learning, students with high academic performance can encourage students with low academic performance. At the same time, self-regulation strategies enable students to actively participate in the learning process and make up for their shortcomings. Team-based learning, complemented by group awareness tools, can create an inclusive environment that supports students across a range of self-regulated learning levels, ensuring that each student's unique learning needs and pace of learning are met. This holistic approach creates a learning environment that benefits all students and helps improve their learning efficiency.[26-28]

5. Practical Applications and Case Studies

5.1 Analysis of recorded teaching courses : An overview of methods for analysing recorded courses to assess the practical application of different teaching methods

A previous paper by Chen, Y. [6] revealed a comprehensive approach to evaluating teaching methods using recorded lessons. It includes analysing interactive questions to facilitate student engagement, leveraging technology for a more immersive learning experience through the FLIPPED model, and strategically using recorded materials to personalise learning paths. This approach emphasises the need for evidence-based education practice. It aims to identify and implement the most effective teaching strategies by thoroughly analysing recorded lessons to improve student learning outcomes. Nevertheless, it can also lead to less interaction between students and teachers.

The Wood study[1, 2] emphasizes the analysis of course replays to evaluate the effectiveness of teaching methods. The FILL+ tool can generate detailed classroom activity data, facilitating professional dialogue and reflective practice among STEMM instructors. This approach encourages educators to consider more interactive teaching strategies. Another of her studies highlights the importance of using classroom practice data to foster meaningful dialogue and reflection, showing that data-driven insights combined with educational development interviews can refine teaching methods.

5.2 Case Studies: Presents case studies demonstrating the successful implementation of adaptive teaching strategies for different learning styles

As the case studies in Physics and Mathematics education demonstrate[8, 20], integrating adaptive teaching strategies across different disciplines emphasizes a dynamic approach that adapts to different learning styles. In physics, using research — based teaching models and interactive tools can facilitate active student learning and bridge the gap between students' intuitive beliefs and scientific concepts. In addition, mathematics education benefits from models such as MSLL and UTE, which also emphasize student active learning, group work, and direct teacher involvement in student learning to support a variety of learner preferences. Together, these case studies highlight the importance of adaptive and student-centred teaching methods in enhancing conceptual understanding and fostering a positive learning environment for all students, demonstrating the successful implementation of adaptive strategies to meet the unique needs of each learner.

6. Conclusion and Recommendations

6.1 Summary of findings: Review the main insights from the literature review

The findings highlight the need for diverse teaching strategies in higher education to accommodate different learning styles, stressing that any single teaching method is insufficient today. It mainly explains the importance of active learning, interactive lectures and integrating cognitive and behavioural theories to strengthen educational practice. The adaptive

teaching strategies highlighted through case studies demonstrate their effectiveness in improving interdisciplinary learning outcomes and creating more inclusive and effective learning environments through personalised and flexible teaching methods. [12, 14, 16, 22]

6.2 Implications for practice: Discuss how these findings can provide adequate information to teachers and students.

Teachers or other educators should take a multi-faceted approach to teaching, combining multiple approaches to meet students' learning styles. This combination can enhance students' understanding of knowledge, improve study skills and develop emotions for each subject. Understanding students' learning preferences can guide them in finding or adapting resources and strategies to optimize learning. Implementing this will require educators to be flexible and innovative in their teaching practices to create a learning environment suitable for most students. [9, 23]

6.3 Recommendations for future research

Future research should explore integrating teaching technology and modern technology in adaptive teaching strategies and examine its impact on different learning styles. Moreover, investigating the long-term effects of differentiated teaching on student achievement in different subjects can provide deeper insights into teaching. In addition, the scalability of individualized teaching methods in large, diverse classrooms must be investigated. Finally, if we understand the role of cultural and socioeconomic factors in learning style preference, we may further improve the teaching methods.

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