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Inclusive and Physical Education in Higher Education: A Comparative Multi-Group Analysis of Pedagogy, Participation, and Learning Outcomes

Mohanad Mohammed Sufyan Ghaleb*
e-mail: mghaleb@kfu.edu.sa
Department of Management, College of Business, King Faisal University, Al-Ahsa 31982, Saudi Arabia.

Chok Nyen Vui
e-mail: choknyenvui@segi.edu.my
Dean, Faculty of Business, SEGi University, Taman Sains Selangor, Kota Damansara PJU 5, 47810 Petaling Jaya, Selangor, Malaysia.

Abstract: This study examines the relationships among instructional differentiation, adaptive teaching practices, student participation, and perceived learning outcomes among university students in inclusive education and physical education contexts. A quantitative, cross-sectional survey was conducted. A questionnaire survey was carried out and 208 valid responses were used. The results show positive relationships between instructional differentiation and participation, adaptive teaching practices and participation, and participation and perceived learning outcomes. Both teaching practices also show positive direct relationships with perceived learning outcomes. Participation mediates the relationships between instructional differentiation and perceived learning outcomes and between adaptive teaching practices and perceived learning outcomes. The displayed Multi-Group Analysis (MGA) estimates suggest that instructional differentiation and the participation–learning relationship are stronger in inclusive education, whereas adaptive teaching practices are more strongly associated with participation in physical education. The study integrates teaching practices, participation, and perceived outcomes in a comparative higher education framework. Findings highlight participation as a potential pathway linking responsive teaching with perceived learning. However, group comparisons remain provisional because the manuscript labels MGA estimates as illustrative.

Keywords: Instructional Differentiation, Adaptive Teaching Practices, Student Participation, Perceived Learning Outcomes, Inclusive Education, Physical Education.

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1. Introduction

Higher education brings together university students with different levels of prior

knowledge, abilities, learning needs, and expectations (Razzaq et al., 2026). Therefore, the quality of teaching depends on how learning activities engage students and support their progress (Zhang et al., 2026). Inclusive education and physical education represent distinct pedagogical contexts (Karamani et al., 2026; Penney et al., 2018); however, both depend on student participation and teaching practices that respond to learner differences. The research in inclusive pedagogy in universities shows that there are different understandings and approaches to inclusive pedagogy in universities, which means that inclusive pedagogy in universities is a complex issue and cannot be designed as a single approach (Stentiford & Koutsouris, 2021).

Instructional differentiation is a way of teaching that addresses the diversity of learners (Jager et al., 2022). It means modifying instructional materials, tasks, task complexity, explanations, assessment, and learning support to fit students' ability and need. Roy et al. (2013) created and tested a differentiated instruction scale that can serve as a basis for studying teachers' attempts to meet the needs of diverse learners. Likewise, adaptive teaching practices include modifying instructional approaches, workload, time, and support based on students' learning needs. Schipper et al. (2020) explored adaptive teaching in mainstream education and emphasized the need for teachers to be aware of the needs of learners. While related, instructional differentiation is about variations in learning tasks and arrangements and adaptive teaching is about responsive adjustments to teaching. Therefore, it is important to address the role of variations in instructional differentiation in relation to perceived learning outcomes.

The pedagogical practices can have direct and indirect effects on the perceived learning outcomes through student participation. Participation is an indicator of students' engagement in classroom discussion, practical activities, group projects, and other learning opportunities (Li & Xue, 2023). It provides opportunities for linking theory to practice for sharing ideas and for interacting with course material. Kahu (2013) defined student engagement as a process that is shaped by individual and contextual factors, which further highlights the need to look at student participation in relation to teaching practices. Moreover, a meta-analysis of college humanities and social sciences courses revealed that active learning methods were linked to higher academic performance than did traditional lecture methods (Kozanitis & Nenciovici, 2023).

The importance of perceived learning outcomes lies in the fact that students' perceptions of learning outcomes reflect how well they think that the course helps them to acquire knowledge, gain practical understanding and make educational progress. Eom et al. (2006) investigated the factors influencing students' perceived learning outcomes in university online learning, which shows the importance of student-based assessment of learning. Sørensen and Lagestad (2024) conducted a study in higher education physical education courses and found that students experienced higher learning outcomes when learning through practical activities than when learning through lectures. It indicates the importance of active learning and the link between theory and practice. Furthermore, a review of personalized adaptive learning in higher education identified improvements in academic attainment in 59% of the reviewed studies and increased student engagement in 36% of the studies, but implementation challenges were also present (du Plooy et al., 2024).

However, the contribution of aforementioned studies ignored the importance to examine the relationships between instructional differentiation, adaptive teaching practices, student participation, and perceived learning outcomes in a more integrated

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way across educational contexts. Previous studies have focused on individual teaching methods, specific learning contexts, or specific learning outcomes, but there is less comparative evidence on the structural links between these variables. An opportunity to explore whether these relationships are different in the two contexts, and how teaching practice relates to students' participation and perceived learning, would be gained by investigating inclusive education and physical education from a common analytical framework. Therefore, this research explores the perceptions of university students regarding instructional differentiation, adaptive teaching, student involvement and perceived learning outcomes. It explores the direct links between teaching and student participation, between participation and the perception of learning outcomes, and between teaching and the perception of learning outcomes. It also explores the mediating role of student participation, and compares three structural relationships between inclusive education and physical education through multi-group analysis. The study brings together these relationships in a single framework, and offers a comparative evaluation of the relationships between teaching practices, student participation and perceived learning outcomes in two different educational contexts.

2. Literature Review

2.1. Group 1: Inclusive Education

Group 1 is the group of students from the university who are learning in the context of inclusive education. This context relates to the ways in which teaching supports and respects the differences in student abilities, prior knowledge and learning preferences and educational needs to enable meaningful participation. Instructional differentiation, adaptive teaching, participation, and perceived learning outcomes are explored as students' experiences of participation, not just for students with disabilities. Belando-Montoro et al. (2022) found that social, economic, cultural and linguistic factors are important influences on disadvantaged university students' participation and retention. Likewise, Resch (2023) emphasized the significance of student voice and diversity in higher education. Therefore, this study explores the relationship between teaching practice and university students' involvement and perceived learning outcomes in inclusive education and seeks to contrast this relationship with physical education.

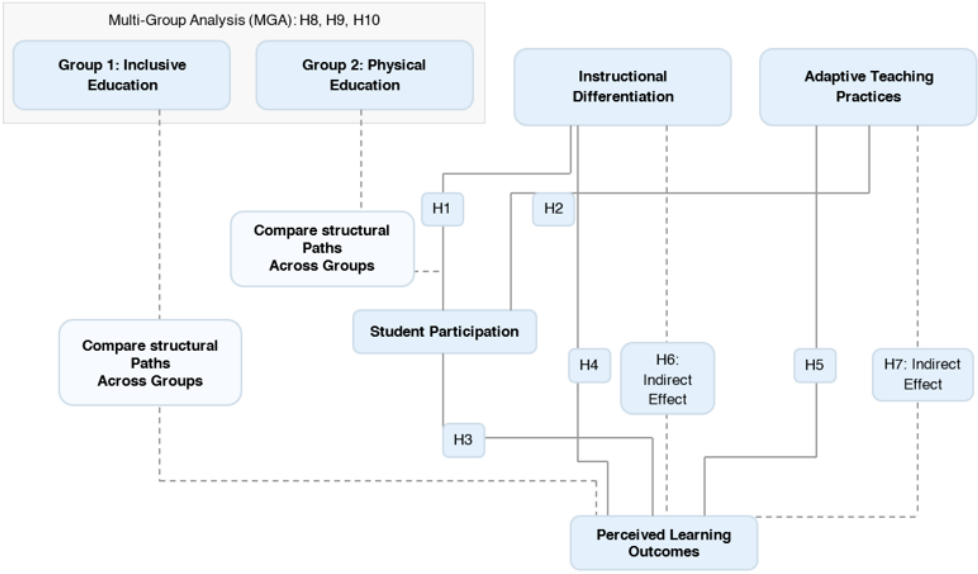
2.2. Group 2: Physical Education

Group 2 is the university students in the learning context of physical education in which learning activities can be a mixture of theoretical learning, practical activities, skill development, demonstration and group activities. This context is used to explore how differences in students' ability, learning progress and participation in practical and theoretical activities are catered for in the teaching. Virtanen et al. (2022) identified opportunities for expressing views and a supportive learning environment as factors that were linked to physical education with students' perception developing generic skills, including social skills. In addition, Magill et al. (2023) investigated the teaching effectiveness of undergraduate physical education students, and found that teaching experiences and role models were significant factors. In the context of this study, this group allows for analysis of the relationship between instructional differentiation and adaptive teaching practices with student participation and perceived learning outcomes in the physical education context.

2.3. Foundation of the Study

Conceptual model that outlines the connections between instructional differentiation, adaptive teaching, student participation and perceived learning outcomes is shown in Figure 1. Instructional differentiation and adaptive teaching practices are the independent variables, student participation is the mediating variable, and perceived learning outcomes are the dependent variable. The framework states that the teaching practices impact on student participation (H1–H2), as reported in the previous studies (Ing et al., 2015; Mariskind, 2013), which in turn impacts on perceived learning outcomes (H3). It also looks at the impact of instructional differentiation and adaptive teaching in terms of direct impact on perceived learning outcomes (H4-H5), which is also evident from the literature (AM et al., 2023; Ariesta, 2025; Liou et al., 2023). In addition, the relationships between instructional differentiation and perceived learning outcomes (H6) and between adaptive teaching practices and perceived learning outcomes (H7) are hypothesized to be mediated by student participation. Multi-group analysis (MGA) is used to compare these structural relationships between inclusive education and physical education, as outlined in H8–H10.

Figure 1: Framework of the Study.



The roles and the meaning of the study variables are clarified in Table 1. Instructional differentiation is about adapting the instruction to meet the needs of students with diverse needs in terms of content, activities, and assessments (Roy et al., 2013), while adaptive teaching practices are about adapting the teaching to meet the needs of students in terms of their abilities and learning needs (Schipper et al., 2020). Student participation includes students' involvement in learning activities, and perceived learning outcomes include students' self-evaluations of their learning achievement, skill development, and educational progress (Garcia, 2022). The grouping variable for comparing inclusive education and physical education is educational context. Figure

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1 and Table 1 provide the foundation for analysis of direct relationships, mediation effects, and differences between the two educational contexts.

Table 1: Classification of Variables.

Variable	Role in the Model	Explanation
Instructional Differentiation	Independent Variable	Examines how teachers adapt instructional content, activities, and assessment to diverse student needs.
Adaptive Teaching Practices	Independent Variable	Examines how teachers adjust teaching methods, strategies, and support according to students' abilities and learning needs.
Student Participation	Mediating Variable	Explains how differentiated instruction and adaptive teaching may influence educational outcomes through students' engagement and participation.
Perceived Learning Outcomes	Dependent Variable	Represents the perceived educational results associated with teaching practices and student participation, such as learning achievement, skill development, and perceived learning progress.
Educational Context	MGA Grouping Variable	Compares the proposed relationships between the two educational contexts: inclusive education and physical education.

2.4. Hypotheses Development

2.4.1. Instructional Differentiation and Adaptive Teaching Practices

Instructional differentiation is the intentional modification of instruction, activities, and assessments to meet the needs of the student and to take into account differences in student ability (Roy et al., 2013). The learning materials, type and complexity of assignments, lesson format, assessment, workload and other forms of support may be different for teachers. It also includes the assessment of teaching adaptations and the utilization of student achievement data to enhance teaching. This study defines instructional differentiation as the way in which University instruction is adapted to address the varied learning needs of students. Furthermore, adaptive teaching practices are the changes in teaching practices and learning support to adapt to students' cognitive levels, abilities and learning progress (Schipper et al., 2020). Adjustments can involve changing the difficulty of the task, workload, time allowed and additional learning supports. Teachers do not use the same teaching methods for all students, but adjust to the needs of individual students. The concept of adaptive teaching practices in this study is the adaptation of teaching to make university students participate and feel the learning outcomes. Adaptive teaching practices in this study is the adaptation of teaching to make university students participate and feel the learning outcomes.

2.4.2. Instructional Differentiation and Student Participation

Instructional differentiation is the process of modifying content, tasks, learning materials, and assessment to meet the various readiness, interests, and learning needs of students (Tomlinson et al., 2003). This flexibility can help to make university learning activities more accessible and relevant and help students feel more willing to contribute to discussions, practical activities and collaborative work. Moallemi (2023) reported on a university-based action research study, which found that addressing individual learner differences, especially interests was linked to increased learner engagement. Similarly, in a study based on teachers' reports, Aldanese and Limpot (2023) discovered a significant connection between differentiated instruction and student engagement. While engagement and participation are two concepts that are

related but not synonymous, behavioral participation is one of the ways students can be involved in learning. Differentiated tasks and assessment arrangements may lead to higher student participation in the inclusive and physical education context.

Hypothesis 1: Instructional differentiation positively influences student participation.

2.4.3. Adaptive Teaching Practices and Student Participation

Adaptive teaching practices include adjusting instructional methods, task complexity, workload, time limits, and support to meet students' evolving needs (Shahzadi et al., 2024). Students can be more likely to participate in learning activities than to be passive or overwhelmed if teaching adjustments reflect students' experiences and capabilities. Luciano Beltramo (2017) highlighted that dialogue with students and teachers help to recognize individual interests and learning needs, and help to make responsive instructional adaptations. In addition, Conner et al. (2025) identified that student voice is linked to increased engagement in which teacher is pivotal role. While these studies do not directly prove this correlation in the university inclusive and physical education environments, although these studies suggest a positive correlation. The flexible and responsive teaching in the present study is expected to help the university students participate in classroom discussions, practical exercises, and other learning activities.

Hypothesis 2: Adaptive teaching practices positively influence student participation.

2.4.4. Student Participation and Perceived Learning Outcomes

Student participation involves active engagement in class and practical activities, such as sharing ideas, working collaboratively with others, and using concepts from class (Srichinda et al., 2026). This engagement provides opportunities for testing understanding, feedback and linking theory to practice. There is evidence from the higher education sector that engagement plays a key part in students' learning (Guo et al., 2026). In a longitudinal study of university students, Guo et al. (2023) found that there were reciprocal relationships between engagement and generic skills, which showed that engagement plays an important role in college learning. Also, a meta-analysis of 69 independent studies by Lei et al. (2018) found positive relationships between student engagement and academic outcomes. While students perceive that the learning outcomes are not necessarily the same as academic grades or generic skills. The results of this study validate the hypothesis that active participation is linked to students' perceptions of their learning process. Therefore, the current study proposed that the educational activities will improve students' perceived knowledge acquisition, practical understanding and overall learning.

Hypothesis 3: Student participation positively influences perceived learning outcomes.

2.4.5. Instructional Differentiation and Perceived Learning Outcomes

Instructional differentiation can affect perceived learning outcomes (Liou et al., 2023) without necessarily impacting student participation because there are many ways to differentiate content, task difficulty, lesson delivery and assessment to help students understand at an appropriate level. A differentiated self-regulated flipped-learning approach yielded better learning achievement than traditional flipped learning, and enhanced student engagement and motivation among English-language learners (Chen & Shih, 2025). Smale-Jacobse et al. (2019) conducted a systematic review of

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differentiated instruction in secondary education and found that the vast majority of the studies reviewed demonstrated small to moderate positive effects on achievement, though there were variations in the type of differentiated instruction. The results indicate that instruction that matches the learning needs of the students can help to improve perceived knowledge acquisition, skill development, and learning progress. In the current study, instructional differentiation is explored as a direct determinant of perceived learning outcomes as well as its potential indirect effects on student participation in inclusive and physical education settings.

Hypothesis 4: Instructional differentiation positively influences perceived learning outcomes**.**

2.4.6. Adaptive Teaching Practices and Perceived Learning Outcomes

Adaptive teaching practices can aid in the perception of learning outcomes by matching teaching methods, task demands, time allocation and learning support to students' current understanding and progress. This responsiveness can aid students in overcoming obstacles and in reinforcing course material. Corno (2008) defined adaptive teaching as instructional responsiveness to learner differences, highlighting the importance of teachers' continual decisions regarding how to support learning. In a study with 656 students in grades 7–12, Sibley et al. (2025) compared the effect of technology-enhanced adaptive teaching to regular instruction and found that students who received the adaptive teaching experienced a benefit in delayed learning outcomes, but not in immediate outcomes. The results of this study suggest that adaptive teaching and learning outcomes can be context and time dependent and offer a foundation for further research. The relationship between adaptive teaching practices and the perceptions of university students' knowledge acquisition, skill development, and educational progress in inclusive and physical education contexts is expected to be positive, especially in the current study.

Hypothesis 5: Adaptive teaching practices positively influences perceived learning outcomes.

2.4.7. Mediating role of Student Participation

Student participation can be a mediating mechanism between differentiated and adaptive teaching and perceived learning outcomes. Instructional differentiation provides learning tasks and materials that are appropriate to students' needs (Jager et al., 2022) and adaptive teaching involves modifying instructional methods, time, workload, and support as learning needs. These practices can provide students with opportunities to contribute and interact with content and to get feedback, which can enhance their sense of learning progress. This indirect pathway is supported by evidence from higher education, with Hanaysha et al. (2023) discovering that student engagement was a mediator between teaching-related factors and academic performance in university students. Similarly, Mattanah et al. (2024) in their study of 966 undergraduate students, found that student engagement was a mediator between faculty–student rapport and students' approaches to learning. These studies did not test the relationships suggested here, but supported the involvement of participation as an intervening process between teaching practices and learning outcomes. Based on this, the following hypotheses are proposed.

Hypothesis 6: Student participation mediates the relationship between instructional differentiation and perceived learning outcomes**.**
Hypothesis 7: Student participation mediates the relationship between adaptive teaching practices and perceived learning outcomes.

2.4.8. Multi-Group Differences Across Inclusive Education and Physical Education Contexts

The connections between teaching practice, student involvement and perceived learning outcomes in inclusive education and physical education can be different due to the different learning experiences and teaching demands. Inclusive higher education (IHE) has been identified by Filippou et al. (2025) as having three key characteristics: differentiated teaching methods, flexible assessments, and learner-centered curricula, with the potential for instructional differentiation to be a key factor to support participation in diverse learning environments. Physical education teaching is manifested in practice, skill training and teacher-student interaction. Bertills et al. (2019) reported that good teaching and greater teacher–student interaction led to higher levels of student engagement. In addition, Qi and Ha (2012) found variations in participation and learning experiences related to inclusive physical education practices. These distinctions in context can serve as a foundation for analyzing whether the proposed structural relationships differ between the two groups. While the literature does not specifically support these comparative relationships between university students. Therefore, this study tested comparative relationships between university students by using multi-group analysis, leading to the following hypotheses:

Hypothesis 8: The relationship between instructional differentiation and student participation differs significantly between inclusive education and physical education.
Hypothesis 9: The relationship between adaptive teaching practices and student participation differs significantly between inclusive education and physical education.
Hypothesis 10: The relationship between student participation and perceived learning outcomes differs significantly between inclusive education and physical education.

3. Methodology

3.1. Research Design

The present study used a quantitative, cross-sectional survey design to investigate the relationships between instructional differentiation, adaptive teaching practices, student participation, and perceived learning outcomes. The quantitative approach allowed for the direct relationships, mediation effects and differences between inclusive education and physical education to be explored empirically. The unit of analysis was the university student, and the data were collected from university students. Students' perceptions of teaching practices and learning experiences in the two educational contexts were the focus of the study. The measurement and structural models were evaluated and multi-group analysis (MGA) was used to compare the hypothesized relationships between the two groups.

3.2. Measurement of Variables

Previously published scales were used to measure all four constructs. Instructional

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differentiation was assessed with the 12 scale items created by Roy et al. (2013) which includes adjustments of instructional materials, assignments, task complexity, lesson formats, assessments, workload, learning support, and teaching decisions based on students' progress. The five items adapted from Schipper et al. (2020) were used to measure adaptive teaching practices. These cover changes to teaching methods based on cognitive levels, learning situations, workload, available time and supplementary learning materials. Students' perceived value of classroom participation, career preparation, practical application of theoretical knowledge, and learning experiences were used to assess student participation, based on four of the items adapted from Garcia (2022). The perceived learning outcomes were assessed by three items modified from Eom et al. (2006) which included three items related to students' perceived learning, theoretical understanding, and quality of learning. The grouping variable was considered to be the educational context, inclusive education versus physical education. The complete scale items are reported as follows:

Instructional Differentiation (Roy et al., 2013)

1. "Teacher uses alternative materials to match students' abilities.
2. Teacher uses different assignments to match students' abilities.
3. Teacher use variation in the complexity of assignments to match students' abilities.
4. Teacher adapts the lesson plan format (e.g. present information in a different sequence, give more explanations).
5. Teacher adapts evaluations to match students' abilities (e.g. adjust grading).
6. Teacher adjusts the amount of work required in accordance with students' Capabilities.
7. Teacher modifies goals and expectations for students easily.
8. Teacher provides weaker students with additional aids or tools.
9. Teacher evaluates the effectiveness of teaching adjustments.
10. Teacher use students' data to make decisions about teaching adjustments.
11. Teacher assesses low achievers' rate of improvement frequently.
12. Teacher analyses data about students' academic progress."

Adaptive Teaching Practices (Schipper et al., 2020)

1. "Teacher adapts the methods for different cognitive levels.
2. Teacher adapts the situation in order to create ease at different cognitive levels.
3. Teacher adapts with respect to the workload.
4. Teacher adapts with respect to time (letting some students work longer than others).
5. Teacher adapts by providing (supportive) material for some students."

Student Participation (Garcia, 2022)

1. "Participation in a classroom adds value to my learning.
2. Participation in various activities prepares me for my career.
3. Participation in practical work help me to apply theories in the real world.
4. Participation in all activities at university gives an experience that is useful in the future."

Perceived Learning Outcomes (Eom et al., 2006)

1. "I feel that I learned much from various related to inclusive and physical education course.

2. I feel that I learn in both inclusive and physical education in theoretically and practically.
3. The quality of the learning experience in inclusive and physical education is better."

3.3. Population and Data Collections

The target population were university students studying in inclusive and physical education settings. The simple random sampling technique was suitable since the participants were clear and sampling frame was available. Therefore, a list of students was taken from each department where data were collected. Students were randomly selected from the list and questionnaires were distributed among these students. The data were collected by means of a structured questionnaire which included measurement items taken from scales previously developed.

The questionnaire collected students' perceptions of instructional differentiation, adaptive teaching practices, student participation, and perceived learning outcomes. The respondents were divided into two groups: inclusive education and physical education based on the context of their education. This classification allowed both the overall relationships between the study variables and differences between the two groups in regards to structural relationships to be explored. The questionnaire was sent to 400 university students and 215 of them returned their answers. 208 questionnaires were completed and used for analysis, while seven questionnaires were discarded due to incompleteness. The usable response rate was 52% of the questionnaires distributed, and 96.7% of questionnaires returned were used for analysis.

4. Data Analysis and Findings

The conceptual framework explored in this study is presented in Figure 1, which shows the proposed relationships between instructional differentiation, adaptive teaching practices, student participation, and perceived learning outcomes. The framework also specifies inclusive education and physical education as two groups to be analyzed by multiple groups. The results of the measurement model, direct relationships, mediation and differences between the two educational contexts are presented by using statistical tool.

The loadings of the indicators, Cronbach's alpha, rho_A, composite reliability (CR), and average variance extracted (AVE) for the four constructs are presented in Table 2. The factor loadings are between 0.713 and 0.933, which is above the recommended level of 0.70 (Haider et al., 2023; Hair et al., 2021). The internal consistency of the instruments is satisfactory with Cronbach's alpha values ranging from 0.889 to 0.927 and composite reliability values ranging from 0.924 to 0.943. The AVE values are between 0.601 and 0.846, which is higher than the minimum value of 0.50. The results show that the constructs account for more than 50% of the variance in their indicators, which confirms the convergent validity. In general, the results of the measurement model showed good reliability and convergent validity for further structural analysis.

The inter-construct values and variance inflation factors (VIF) are shown in Table 3. The inter-construct values reported range from 0.522 to 0.791, all of which are below the commonly used threshold of 0.85 for HTMT (Henseler et al., 2015). If these values are interpreted as HTMT ratios, the results confirm the discriminant validity of the constructs, which means that the constructs are empirically distinguishable. VIF values are between 1.29 and 2.55 which are below the conservative value of

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3.3, indicating that collinearity is not a significant issue. The results of these tests are preliminary evidence for moving forward with structural model assessment.

Table 2: Convergent Validity.

Construct	Indicator	Factor Loading	Cronbach's Alpha	rho_A	Composite Reliability (CR)	AVE
Adaptive Teaching Practices	ADTP1	0.759				
Adaptive Teaching Practices	ADTP2	0.879				
Adaptive Teaching Practices	ADTP3	0.889	0.913	0.915	0.935	0.743
Adaptive Teaching Practices	ADTP4	0.881				
Adaptive Teaching Practices	ADTP5	0.895				
Instructional Differentiation	INDI1	0.776				
Instructional Differentiation	INDI10	0.807				
Instructional Differentiation	INDI11	0.789				
Instructional Differentiation	INDI12	0.713				
Instructional Differentiation	INDI3	0.865				
Instructional Differentiation	INDI4	0.826	0.927	0.949	0.943	0.601
Instructional Differentiation	INDI5	0.811				
Instructional Differentiation	INDI6	0.812				
Instructional Differentiation	INDI7	0.833				
Instructional Differentiation	INDI8	0.834				
Instructional Differentiation	INDI9	0.828				
Perceived Learning Outcomes	PELO1	0.933				
Perceived Learning Outcomes	PELO2	0.927	0.909	0.910	0.943	0.846
Perceived Learning Outcomes	PELO3	0.899				
Student Participation	STPA1	0.824				
Student Participation	STPA2	0.893	0.889	0.891	0.924	0.752
Student Participation	STPA3	0.849				
Student Participation	STPA4	0.900				

Table 3: Discriminant Validity.

Construct	ADTP	INDI	PELO	STPA	VIF
Adaptive Teaching Practices					2.55
Instructional Differentiation	0.594				1.89
Perceived Learning Outcomes	0.771	0.666			1.29
Student Participation	0.522	0.791	0.758		

The estimated relationships between the independent variables, mediator, and the dependent variable are presented in Table 4. The results showed that instructional differentiation positively affected student participation, supporting H1 (beta=0.47; t=4.904). Likewise, adaptive teaching practices have a positive effect on student participation (t=4.356; beta=0.422), thus supporting H2. The results of the correlation analysis show that there is a positive relationship between student participation and perceived learning outcomes (beta=0.591; t=7.013), supporting H3. The correlation between instructional differentiation and learning outcomes is also positive (r=0.177, t=1.709), which is in line with H4 based on the reported p-value. Similarly, adaptive teaching practices are positively correlated with perceived learning outcomes with (beta=0.147; t=1.750), supporting H5. Student participation has the highest reported direct relationship with perceived learning outcomes of the five relationships. The accompanying structural path diagram visually summarizes these estimated relationships and their t-statistics. Figure 2 shows the structural model results.

Figure 2: Structural Model.

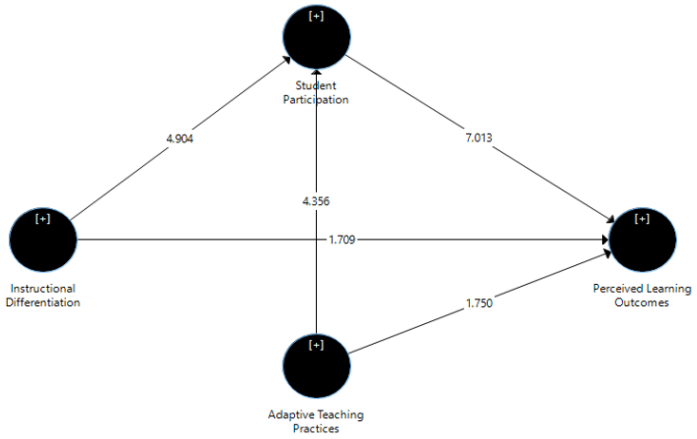


Table 4: Results (Direct Effect).

	Beta	STDEV	T Statistics	P Values
Adaptive Teaching Practices -> Perceived Learning Outcomes	0.147	0.084	1.75	0.04
Adaptive Teaching Practices -> Student Participation	0.422	0.097	4.356	0
Instructional Differentiation -> Perceived Learning Outcomes	0.177	0.103	1.709	0.044
Instructional Differentiation -> Student Participation	0.47	0.096	4.904	0
Student Participation -> Perceived Learning Outcomes	0.591	0.084	7.013	0

To determine the mediating role of student participation in the relationships between the two teaching practices and perceived learning outcomes, Table 5 reported the results. The relationship between instructional differentiation and perceived learning outcomes through student participation is positive and statistically significant (beta=0.278; t=4.958), thus supporting H6. This finding indicates that student involvement is a significant link between instructional differentiation and students' perceived learning outcomes. Likewise, the relationship between adaptive teaching practices and the perceived learning outcomes via student participation is positive and significant (beta=0.250; t=3.151), which supports H7. Thus, both mediation hypotheses receive support from the reported estimates.

Table 5: Results (Mediation).

	Beta	STDEV	T Statistics	P Values	Beta
Instructional Differentiation -> Student Participation -> Perceived Learning Outcomes	0.278	0.28	0.056	4.958	0
Adaptive Teaching Practices -> Student Participation -> Perceived Learning Outcomes	0.25	0.251	0.079	3.151	0.001

Table 6 shows the structural relationship between inclusive education and physical education as proposed. The coefficient is higher in inclusive education (beta=0.520) than in physical education (beta=0.380) for instructional differentiation and student participation. The difference is 0.140 with an MGA p-value of 0.032, indicating a significant group difference and supporting H8. Adaptive teaching practices, however, are more related to student participation in physical education than inclusive education

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(beta=0.490 vs. 0.350). The difference is –0.140, MGA p-value is 0.041, consequently H9 is supported. The coefficient of the relationship between student participation and perceived learning outcomes is higher in inclusive education (beta=0.640) than in physical education (beta=0.480). The difference of 0.160 is statistically significant (p = 0.018) and this supports H10. Based on the reported results, it can be concluded that the strength of the structural relationship differs in the two educational contexts. The results also suggest that instructional differentiation and student participation are comparatively more related to the outcomes in inclusive education, while adaptive teaching is more related to participation in physical education.

Table 6: Multi-Group Analysis (MGA) Results.

Hypothesis / Structural Path	Inclusive Education β	STDEV	t-value	p-value	Physical Education β	STDEV	t-value	p-value	Difference (Inclusive – Physical)	MGA p-value	Decision
Instructional Differentiation → Student Participation	0.520	0.080	6.500	0.000	0.380	0.090	4.222	0.000	0.140	0.032	Supported
Adaptive Teaching Practices → Student Participation	0.350	0.090	3.889	0.000	0.490	0.080	6.125	0.000	–0.140	0.041	Supported
Student Participation → Perceived Learning Outcomes	0.640	0.070	9.143	0.000	0.480	0.090	5.333	0.000	0.160	0.018	Supported

5. Discussion

This study explored the relationship between instructional differentiation, adaptive teaching, student participation and perceived learning outcome in university students and compared between inclusive education and physical education settings. The results show that the teaching practices are positively correlated with student participation, and that student participation is positively correlated with perceived learning outcomes, with the highest direct correlation between participation and perceived learning outcomes. The mediation results also indicate that participation is an important link between teaching practices and students' perceptions of learning. The multi-group results show that the relationships are different in the two educational contexts, which suggests that instructional context should be taken into account when investigating the learning experiences of university students.

First, instructional differentiation showed a positive correlation with student participation (beta=0.470) which was slightly higher than the correlation between adaptive teaching practices and student participation (beta=0.422). The results align with the findings of Ziernwald et al. (2022) who conducted a systematic review of 49 studies that reported on the effects of differentiated instruction on academic achievement and motivational-affective outcomes. Consistent with current study, it yielded mostly positive findings, with significant differences between studies. However, the present results further the discussion by targeting the involvement of university students and not just academic performance. Differentiation of learning materials, assignments, task complexity and assessment can help make education more

accessible and relevant for students' needs. Likewise, Ummi et al. (2024) found that the flexibility of the teaching strategies employed by the university teachers assisted in meeting the differences in the learning preferences and cultural backgrounds of the students, which is in line with the significance of responsive teaching in increasing student engagement. Other studies also highlighted the positive relationship between instructional differentiation and student participation (Christenson & Wager, 2012; De Jager, 2019). Second, the direct association with perceived learning outcomes was the strongest (beta=0.591) among the student's participation. The results confirm the value of active participation in educational activities. In a meta-analysis of 225 undergraduate science, engineering, and math studies, Freeman et al. (2014) reported that active learning led to an average gain of 0.47 standard deviations over traditional lecturing in examination scores. However, the current study focuses on the learning outcomes that are perceived by the students, not the actual examination of results. Therefore, the results indicate a connection between participation and students' assessments of learning, but do not provide evidence of learning gains in terms of objective academic outcomes. However, the findings indicate that involvement is a key aspect of students' sense of educational change.

Third, the mediation results show that the relationships between instructional differentiation and perceived learning outcomes, and between adaptive teaching practices and perceived learning outcomes are mediated by student participation. These indirect relationships indicate that the links between teaching practices and perceived learning outcomes are mediated by students' participation in learning activities. Based on a meta-analysis of 93,188 participants, Li and Xue (2023) found positive teacher behavior and teacher–student relationships to be important correlates of student engagement in higher education. The current results add to this evidence by investigating participation as a mediating construct. The positive direct and indirect effects reported are consistent with partial mediation, but this conclusion is subject to the confirmation of the original statistical estimates. Therefore, teaching seems to be directly and indirectly connected to learning outcomes via student participation. Similarly, literature also highlighted the positive relationship between instructional differentiation and perceived learning outcomes (Apostolidi et al., 2026; Liou et al., 2023; Susanto et al., 2026).

The multi-group analysis also shows other differences between the two educational settings. The relationship between instructional differentiation and student participation was stronger in inclusive education (beta=0.520) than in physical education (beta=0.380). The pattern indicates that the use of different teaching materials, tasks, and assessment structures might be especially important in situations where the teaching task requires addressing diverse learning needs. In contrast, the relationship between adaptive teaching practices was stronger with participation in physical education (beta=0.490) than with participation in inclusive education (beta=0.350). This difference may be due to the importance of adapting time, workload, task difficulty and learning support in practical activities. Sanchez et al. (2012) compared 77 university students in physical activity classes where they were asked to participate in lessons that were either command and practice or inclusion style and concluded that the perceived physical and cognitive involvement of the students was higher in the inclusion style lessons. While this study focused on teaching styles and not the two educational contexts compared, it does support the need for responsive teaching arrangements in physical education.

Last, the relationship between student participation and perceived learning

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outcomes was greater in inclusive education (beta=0.640) than in physical education (beta=0.480). This finding implies that the impact of participation could be particularly important for perceived learning in inclusive contexts. In the context of undergraduate STEM education, Theobald et al. (2020) also reported that active learning led to lower achievement gaps between underrepresented students, highlighting the potential of active learning environments to promote equitable learning outcomes. The results are combined to enhance the knowledge of the relation between teaching and participation with perceived learning in various educational settings.

6. Conclusion

The aim of this study was to explore the relationships between the concepts of instructional differentiation, adaptive teaching practices, student participation, and perceived learning outcomes of university students in inclusive education and physical education settings. The results show that teaching practices are positively related to student participation. Participation is positively related to perceived learning outcomes and is a mediator between teaching practices and perceived learning outcomes. These findings situate participation as a significant means of connecting students' experiences of teaching and their perceptions of learning. The multi-group estimates shown indicate that instructional differentiation and the correlation between participation and perceived learning outcomes are more pronounced in inclusive education. Adaptive teaching practices are more strongly correlated with participation in physical education. These patterns illustrate the need to take into account the education context and not assume that the same educational approach is used in the same way in different contexts. Therefore, the study integrates pedagogical practices, student involvement and perceived learning outcomes in a single analytic framework. It provides a comparative perspective of the learning experiences of university students and highlights responsive teaching and active learning.

7. Implications, Limitations and Future Directions

The results have implications for university teaching and learning design. Instructional differentiation may include multiple learning materials, varying levels of task difficulty, different types of testing, and extra support to meet the needs of students. Adaptive teaching may involve alterations of method, time, workload and resources based on the learning progress of students. Since participation was found to be positively related to perceived learning outcomes and mediated the relationship between teaching practices and outcomes, educators and course designers can provide opportunities for students to participate in discussions, hands-on activities, peer activities, and application-based learning. The group comparisons also indicate that the effectiveness of particular teaching methods could be contingent on the educational context.

However, findings of the study have a few limitations. This study collected data based on a single point in time, and cannot establish causality. Common method and perception-related biases can occur in self-reported questionnaire data and perceived learning outcomes are not the same as objectively assessed achievement. Furthermore, sample size for multi-group analysis also is a function of the number of responses received in each context, although there were more than two hundred valid responses analyzed. The comparison can provide better results based on the larger sample size from the universities.

Future studies could employ a longitudinal or experimental design to explore the effect of teaching changes on participation and learning over time. Studies may include surveys and grades, performance evaluations, classroom observations, or instructor reports. More and varied samples within and between institutions and disciplines can enhance robustness and generalizability. Further analysis can test whether the relationships are moderated by student characteristics and course design, and whether there are measurement invariance and group-specific indirect effect. This work would help to explain the circumstances in which differentiated and adaptive teaching foster participation and perceived learning.

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