Journal of Studies in Elementary Education
2026, VOL. 02, NO. 01, 01-16
https://doi.org/10.64268/jsee.v2i1.120

Preservice Mathematics Teachers' Perception of Differentiated Assessment

Atar Alphaa Mohammed[1], Nicholas Essien[2], Gabina Susuoraka[3]
[1] Nusrat Jahan Ahmadiyya College of Education, Ghana
[2] Offinso College of Education, Ghana
[3] University of Business and Integrated Development Studies, Ghana

ataralphaa.mohammed@stu.ucc.edu.gh

ABSTRACT
Background: Differentiated assessment is increasingly recognised as an important aspect of effective mathematics instruction because it addresses learners' diverse abilities, interests, and learning needs. However, limited attention has been given to how preservice mathematics teachers perceive its use in classroom practice.
Aims: This study explored preservice mathematics teachers' perceptions of differentiated assessment and examined whether sex, educational level, and programme of study influence these perceptions.
Methods: A quantitative survey design was adopted for the study. Data were gathered from 203 preservice mathematics teachers in a College of Education in Ghana through a structured questionnaire. Descriptive statistics, independent-samples t-test, and one-way ANOVA were used to analyse the data.
Result: The findings indicated that participants generally held favourable views toward differentiated assessment. They believed it supports fairness, inclusion, and students' confidence in mathematics learning. The study also revealed some implementation concerns, including limited instructional resources, large class sizes, and time constraints. Statistical analysis further showed that sex, educational level, and programme of study did not significantly influence participants' perceptions.
Conclusion: Preservice mathematics teachers demonstrated positive perceptions of differentiated assessment regardless of demographic differences. The study highlights the need for practical training and continuous support to improve teachers' confidence and competence in applying differentiated assessment strategies in mathematics classrooms.

ARTICLE HISTORY
Submitted: January 16, 2026
Accepted: March 21, 2026
Published: May 28, 2026

KEYWORD
Differentiated Assessment; Inclusive Education; Mathematics Education; Preservice Mathematics Teachers; Teacher Perception;

Introduction

The increasing diversity of students' learning needs in contemporary classrooms has encouraged educators to reconsider conventional approaches to teaching and assessment. In mathematics education, learners differ substantially in their prior knowledge, cognitive abilities, motivation, and learning preferences, making uniform assessment practices less effective in supporting equitable learning outcomes. As a response to these differences, differentiated instruction has gained recognition as an inclusive pedagogical framework that allows teachers to adapt content, process, product, and assessment according to students' characteristics (Grecu, 2023; Lindner & Schwab, 2025). Among these components, differentiated assessment has become increasingly important because it enables learners to demonstrate understanding through varied methods that align with their abilities and learning profiles. Recent educational reforms have also emphasized the necessity of assessment practices that are responsive, flexible, and learner-centered rather than solely standardized (Mir, 2025). Consequently, differentiated assessment is now viewed not only as a measurement tool but also as a strategy for promoting participation, fairness, and meaningful mathematical learning.

The growing emphasis on inclusive education has further strengthened the relevance of differentiated assessment in mathematics classrooms. In many educational contexts, teachers continue to rely heavily on traditional paper-and-pencil examinations that often privilege students with stronger academic backgrounds while disadvantaging learners with diverse needs. Such practices may limit

students' opportunities to express mathematical understanding in alternative ways and can negatively affect confidence and engagement (Cevikbas & Kaiser, 2022). Empirical evidence has shown that inflexible assessment systems contribute to unequal learning experiences, particularly in mixed-ability classrooms where learners require varying levels of instructional support (Barbier et al., 2023; Ziernwald et al., 2022). At the same time, mathematics is frequently perceived as a difficult subject that generates anxiety and fear among learners, making assessment practices especially influential in shaping students' attitudes toward learning. Scholars have therefore argued that assessment should function as a supportive and developmental process rather than merely a mechanism for grading performance (Aguilera et al., 2024). These realities highlight the importance of preparing future mathematics teachers to design and implement assessment approaches that accommodate learner diversity.

Preservice mathematics teachers play a critical role in determining how differentiated assessment will be implemented in future classrooms. Teacher education institutions are expected to equip preservice teachers with the pedagogical knowledge and practical competence necessary to address diverse learning needs effectively. However, recent studies suggest that many preservice teachers still possess limited understanding of differentiated assessment despite acknowledging its educational value (Obrovská et al., 2024; Zaier & Maina, 2022). In some cases, they perceive assessment primarily as a tool for accountability rather than as a means of supporting instruction and student growth. This situation raises concerns because teachers' perceptions and beliefs strongly influence their future classroom practices and willingness to adopt innovative assessment methods (Abel et al., 2022). Furthermore, inadequate preparation in assessment literacy may reduce teachers' confidence in adapting assessment tasks for learners with varying abilities. Therefore, investigating preservice mathematics teachers' perceptions of differentiated assessment is essential for understanding their readiness to implement inclusive assessment practices.

The urgency of examining differentiated assessment has increased alongside ongoing global discussions about educational equity and quality teaching. Educational stakeholders increasingly recognize that effective mathematics instruction cannot be separated from appropriate assessment strategies that support learner participation and achievement. Studies conducted during and after the COVID-19 pandemic demonstrated that rigid assessment systems often failed to address learners' diverse circumstances and learning conditions (Babbar & Gupta, 2022). As a result, educators and researchers have advocated for more adaptive assessment approaches capable of responding to students' academic and socio-emotional needs. Differentiated assessment offers opportunities for teachers to use multiple forms of evidence in evaluating students' mathematical understanding while reducing barriers associated with one-dimensional testing methods. In addition, responsive assessment practices can enhance students' confidence, motivation, and engagement in mathematics learning (Lo & Hew, 2021). Considering these developments, understanding how preservice mathematics teachers perceive differentiated assessment remains both timely and necessary.

A growing body of literature has explored differentiated instruction and assessment in mathematics education from different perspectives. Ramaila, (2025) ; Subandiyah et al. (2025) found that differentiated instruction positively supports learner engagement and achievement when implemented systematically in classroom practice. Similarly, Töllner et al. (2025) emphasized that formative and diagnostic assessments are essential elements in successful differentiated mathematics instruction. Research by Herner-Patnode & Lee (2021) further demonstrated that responsive teaching strategies encourage mathematics teachers to tailor assessment practices according to students' readiness and learning profiles. Other studies have shown that differentiated assessment can improve fairness and reduce learning anxiety among students. In addition, Endale et al. (2024) reported that assessment-informed instruction contributes to more accurate teacher understanding of students' academic competence. These findings collectively suggest that differentiated assessment has strong potential to improve learning experiences and instructional effectiveness in mathematics classrooms.

Although prior studies provide valuable insights, existing literature reveals several important limitations. First, much of the current research has concentrated on differentiated instruction generally, with greater emphasis placed on content delivery rather than assessment practices specifically Morris et al. (2021). Second, studies investigating differentiated assessment often focus on in-service teachers, leaving preservice mathematics teachers comparatively underexplored van den Kieboom & Groleau, (2022). Third, previous research has largely examined teachers' implementation challenges without sufficiently addressing how demographic variables such as sex, educational level, and programme of study influence perceptions of differentiated assessment. Furthermore, many studies were conducted in Western or highly developed educational contexts, limiting understanding of how differentiated assessment is perceived within developing educational systems. Existing evidence also indicates inconsistencies regarding teachers' confidence and readiness to apply differentiated assessment strategies effectively Croutch (2023). These limitations demonstrate the need for further research that specifically investigates preservice mathematics teachers' perceptions within diverse educational environments.

Another important concern emerging from the literature relates to teachers' self-efficacy and assessment competence. According to Bandura's self-efficacy theory, teachers who believe in their instructional capabilities are more likely to adopt innovative and student-centered practices. Studies by Vidergor (2023) revealed that teachers' self-efficacy significantly predicts their willingness to adapt assessment strategies and provide individualized support for learners. Similarly, culturally responsive teaching theory emphasizes the importance of designing assessment practices that acknowledge students' sociocultural and educational differences. However, several studies indicate that preservice teachers often lack sufficient practical training in designing flexible and inclusive assessments. Without adequate preparation, future teachers may struggle to translate theoretical understanding into effective classroom practice. Consequently, examining preservice mathematics teachers' perceptions of differentiated assessment can contribute to a deeper understanding of their preparedness and professional needs.

Based on the identified gaps, this study aims to examine preservice mathematics teachers' perceptions of differentiated assessment and to determine whether sex, educational level, and programme of study significantly influence these perceptions. The study contributes theoretically by extending existing discussions on differentiated instruction through a specific focus on assessment practices within mathematics education. It also contributes practically by providing evidence that may inform teacher education programmes, curriculum developers, and policymakers in designing training initiatives that strengthen assessment literacy and inclusive instructional competence among future mathematics teachers. By focusing on preservice teachers, the study offers insights into how differentiated assessment is understood before teachers fully enter professional practice. The findings are expected to support the development of more responsive mathematics classrooms where assessment serves as a tool for equity, participation, and meaningful learning. Ultimately, this research reinforces the importance of preparing future mathematics teachers who are capable of addressing learner diversity through effective and inclusive assessment practices.

Method

This study employed a quantitative research approach grounded in the positivist paradigm to examine preservice mathematics teachers' perceptions of differentiated assessment. A cross-sectional survey design was adopted because it allows researchers to collect data from a relatively large group of participants within a specific period and to statistically examine patterns, relationships, and group differences. The design was considered appropriate for the present study because the research aimed to investigate participants' perceptions and determine whether demographic variables such as sex, educational level, and programme of study significantly influenced these perceptions. Furthermore, the

survey approach enabled the researchers to obtain standardized responses that could be analyzed objectively using inferential statistical techniques.

Research Design

A quantitative, cross-sectional survey design was employed in this study. This design was selected because it is suitable for examining perceptions and identifying group differences at one point in time using standardized instruments. It aligns with the study's objective of describing preservice mathematics teachers' perceptions of differentiated assessment and examining whether sex, educational level, and programme of study significantly influence these perceptions. The overall research procedure followed a systematic sequence beginning from problem identification to interpretation of findings.

Research Procedure

Figure 1. Research Procedure Flowchart

The research procedure began with the identification of the research problem, followed by an extensive review of related literature on differentiated assessment and mathematics education. Subsequently, the research instrument was developed and subjected to expert validation and pilot testing to ensure clarity, validity, and reliability. After revising the questionnaire, participants were selected through a multistage sampling technique, and data were collected online using Google Forms. The collected responses were screened and cleaned before being analyzed statistically using SPSS version 24. Finally, the findings were interpreted and reported systematically according to the objectives of the study.

Participant

The target population comprised all preservice mathematics teachers enrolled in a College of Education in the Upper West Region of Ghana across Levels 100 to 400, with a total population of 696 students. A sample of 203 preservice mathematics teachers participated in the study. The participants were drawn from three programmes: Early Childhood Education, Primary Education, and Junior High

School Education. A multistage sampling technique was used to ensure adequate representation across the different educational levels and programmes of study. Initially, participants were stratified according to educational level and programme of study, after which proportionate sampling was applied to select respondents from each subgroup. Only students who were officially enrolled in mathematics-related teacher education programmes and voluntarily consented to participate were included in the study. Incomplete or invalid responses were excluded from the final analysis.

Instrument

Data were collected using a structured questionnaire developed from previous studies on differentiated instruction, classroom assessment, and inclusive mathematics education. The instrument consisted of two sections. The first section gathered demographic information, including sex, educational level, and programme of study. The second section contained 32 Likert-scale items measuring four dimensions: perceived understanding of differentiated assessment, perceived beliefs regarding differentiated assessment, perceived readiness to implement differentiated assessment, and perceived challenges associated with its implementation. Responses were rated on a four-point Likert scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). To ensure the quality of the instrument, content validity was established through expert judgment involving three specialists in mathematics education and educational assessment. Their suggestions were incorporated to improve the wording, relevance, and clarity of the questionnaire items. A pilot study was subsequently conducted outside the main sample, and reliability testing using Cronbach's alpha coefficient produced an overall reliability index of 0.953, while the subscales ranged from 0.843 to 0.912. These values indicated satisfactory internal consistency and reliability of the instrument.

Data Analysis

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24. Descriptive statistics, specifically means and standard deviations, were used to summarize participants' perceptions of differentiated assessment. Mean score interpretation followed the following criteria: scores below 2.50 indicated negative perception, scores between 2.50 and 2.99 indicated moderately positive perception, and scores of 3.00 and above indicated positive perception. Inferential statistical analyses were also conducted to examine group differences. An independent-samples t-test was used to determine differences based on sex, while one-way ANOVA was employed to examine differences across educational levels and programmes of study. Before conducting inferential analyses, assumptions of normality and homogeneity of variances were assessed using Shapiro–Wilk and Levene's tests. Statistical significance was determined at the 0.05 alpha level.

Ethical Considerations

Ethical approval was obtained from the relevant institutional authorities prior to data collection. Participation in the study was voluntary, and informed consent was obtained from all participants before they completed the questionnaire. Participants were informed about the purpose of the study, their right to withdraw at any time, and the confidentiality of their responses. No personally identifiable information was collected, and all data were used strictly for academic purposes. The researchers adhered to ethical principles of honesty, confidentiality, transparency, and respect for participants' rights throughout the research process.

Results and Discussion

Results

Research Question 1: What is the perception of preservice mathematics teachers regarding the integration of differentiated assessment in their future mathematics classrooms? To gain conceptual understanding of research question one, PMTs responses were analysed via means and standard deviations. The summary of their responses is presented in Table 1.

Table 1: PMT's Perception of integrating differentiated assessment in their mathematics classrooms (N = 203)

Item | Perceived understanding of differentiated assessment	Mean	Std. Deviation
1. I understand the concept of differentiated assessment.	2.91	.976
2. Differentiated assessment is applicable in mathematics education.	2.70	1.031
3. I can distinguish between assessment for learning and assessment of learning.	3.12	.995
4. I am aware of different ways to assess mathematical thinking.	3.03	.969
5. I learnt about differentiated assessments during my teacher training.	3.09	.863
6. I know how to align differentiated assessment with curriculum objectives.	2.93	.906
7. I understand how differentiated assessment supports inclusive education.	3.25	.851
8. I can explain the difference between product, process, and content differentiation in assessment.	3.06	.851
Item | Perceived Beliefs about Differentiated Assessment	**Mean**	**Std. Deviation**
9. Differentiated assessment promotes fairness in mathematics classrooms.	3.33	.742
10. It is possible to assess students with different mathematical abilities fairly.	3.06	.871
11. Differentiated assessment helps identify students' strengths and needs.	3.33	.786
12. Mathematics should only be assessed using standardised methods.	2.72	.941
13. I believe differentiated assessment can improve students' mathematical confidence.	3.13	.829
14. All students deserve assessment methods that reflect their learning styles.	3.32	.778
15. Differentiated assessment is more beneficial than traditional assessment.	2.86	1.010
16. I believe differentiated assessment can reduce anxiety among learners.	3.03	.878
Item | Perceived Readiness to incorporate Differentiated Assessment	**Mean**	**Std. Deviation**
17. I feel prepared to use differentiated assessment in my future classroom	3.19	.776
16. I know how to design math tasks with multiple entry points.	2.88	.854
18. I can adapt assessment tasks for students with different learning needs.	3.03	.780
19. I practiced using differentiated assessments during my teaching practicum.	3.14	.765
20. I can use rubrics and checklists to support differentiated assessment.	3.10	.751
21. I know how to use formative assessment to guide differentiation.	3.12	.751
22. I can provide students with choices in how they demonstrate understanding.	3.06	.815
23. I am confident in assessing students with disabilities or learning difficulties.	3.09	.762
Item| Perceived Challenges in Incorporating Differentiated Assessment	**Mean**	**Std. Deviation**
24. I need more training on differentiated assessment in mathematics.	3.02	.853
25. Mathematics content makes differentiation more difficult than other subjects.	2.59	.931
26. I lack examples of differentiated assessment tasks in mathematics.	2.60	.817
27. I worry about managing time when differentiating assessments.	2.72	.936
28. I would benefit from mentorship or peer collaboration on assessment design.	3.07	.783
29. Large class sizes make it difficult to implement differentiated assessment.	2.93	.920
30. I find it challenging to assess students fairly when using different methods.	2.64	.920
31. I need more digital tools and resources to support differentiated assessment.	3.10	.796
Mean of Means and Overall (Pooled) Standard Deviation	3.06	2.65
Item | Perceived understanding of differentiated assessment	**Mean**	**Std. Deviation**
1. I understand the concept of differentiated assessment.	2.91	.976
2. Differentiated assessment is applicable in mathematics education.	2.70	1.031
3. I can distinguish between assessment for learning and assessment of learning.	3.12	.995
4. I am aware of different ways to assess mathematical thinking.	3.03	.969
5. I learnt about differentiated assessments during my teacher training.	3.09	.863
6. I know how to align differentiated assessment with curriculum objectives.	2.93	.906
7. I understand how differentiated assessment supports inclusive education.	3.25	.851
8. I can explain the difference between product, process, and content differentiation in assessment.	3.06	.851
Item | Perceived Beliefs about Differentiated Assessment	**Mean**	**Std. Deviation**
9. Differentiated assessment promotes fairness in mathematics classrooms.	3.33	.742
10. It is possible to assess students with different mathematical abilities fairly.	3.06	.871
11. Differentiated assessment helps identify students' strengths and needs.	3.33	.786

12. Mathematics should only be assessed using standardised methods.	2.72	.941
13. I believe differentiated assessment can improve students' mathematical confidence.	3.13	.829
14. All students deserve assessment methods that reflect their learning styles.	3.32	.778
15. Differentiated assessment is more beneficial than traditional assessment.	2.86	1.010
16. I believe differentiated assessment can reduce anxiety among learners.	3.03	.878
Item | Perceived Readiness to incorporate Differentiated Assessment	**Mean**	**Std. Deviation**
17. I feel prepared to use differentiated assessment in my future classroom	3.19	.776
16. I know how to design math tasks with multiple entry points.	2.88	.854
18. I can adapt assessment tasks for students with different learning needs.	3.03	.780
19. I practiced using differentiated assessments during my teaching practicum.	3.14	.765
20. I can use rubrics and checklists to support differentiated assessment.	3.10	.751
21. I know how to use formative assessment to guide differentiation.	3.12	.751
22. I can provide students with choices in how they demonstrate understanding.	3.06	.815
23. I am confident in assessing students with disabilities or learning difficulties.	3.09	.762
Item| Perceived Challenges in Incorporating Differentiated Assessment	**Mean**	**Std. Deviation**
24. I need more training on differentiated assessment in mathematics.	3.02	.853
25. Mathematics content makes differentiation more difficult than other subjects.	2.59	.931
26. I lack examples of differentiated assessment tasks in mathematics.	2.60	.817
27. I worry about managing time when differentiating assessments.	2.72	.936
28. I would benefit from mentorship or peer collaboration on assessment design.	3.07	.783
29. Large class sizes make it difficult to implement differentiated assessment.	2.93	.920
30. I find it challenging to assess students fairly when using different methods.	2.64	.920
31. I need more digital tools and resources to support differentiated assessment.	3.10	.796
Mean of Means and Overall (Pooled) Standard Deviation	3.06	2.65

The data in Table 1 indicates that PMTs' had a favourable perception about the integration of differentiated assessment in their classrooms. For perceived understanding, item means range from 2.70 (SD = 1.031) to 3.25 (SD = 0.851), indicating moderate to high self-reported comprehension; the highest rating pertains to the role of differentiation in inclusive education (M = 3.25, SD = 0.851). Beliefs about differentiated assessment are similarly favourable, with means spanning 2.72 (SD = 0.941) to 3.33 (SD ≈ 0.74), suggesting strong endorsement of fairness, strength identification, and confidence-building benefits. The most skeptical view concerns exclusive reliance on standardised methods (M = 2.72, SD = 0.941). Readiness scores demonstrate confidence in implementation, particularly for future classroom use (M = 3.19, SD = 0.776) and for adapting tasks to diverse needs (M ≈ 3.03–3.14, SD ≈ 0.75–0.87). However, designing tasks with multiple entry points yielded a lower mean (M = 2.88, SD = 0.854), indicating a relatively moderate growth. Challenges are perceived as moderate, with the greatest difficulty reported for content-specific differentiation in mathematics (M = 2.59, SD = 0.931) and the lowest for needing additional digital tools (M = 3.10, SD = 0.796). Concerns about time management and large class sizes hover around the mid-range (M ≈ 2.72–2.94). In all, the aggregate "Mean of Means" (M = 3.06) reflects a generally favourable stance toward differentiated assessment, tempered by identified instructional and logistical challenges that warrant targeted professional development.

Research Hypotheses

H0: Sex has no statistically significant impact on PMT's perception of differentiated assessment.

Table 2. PMT's Perception of Differentiated Assessment based on Sex (N = 203)

	1. Sex	N	Mean	Std. Deviation	Std. Error Mean
PCDA	Male	83	94.8434	18.77497	2.06082
	Female	120	96.8250	16.38746	1.49596

Table 2 highlights the variability in PMTs' perception about differentiated assessment by sex (Male and Female). Male teachers (n = 83) reported a mean PCDA score of M = 94.84 (SD = 18.77, SE = 2.06), whereas female teachers (n = 120) reported a slightly higher mean of M = 96.83 (SD = 16.39, SE = 1.50).

The difference between the two group means is Δ = 96.83 – 94.84 ≈ 1.99 points, suggesting a modest advantage for females. These occurrences gave impetus to the execution of an independent-samples t-test to authenticate the inferences from the descriptive statistics.

Table 3. Independent Sample T-test of PMT's Sex (Male/Female) and Perception of Differentiated Assessment

	Levene's test				Effect size	95% CI	
PCDA	F	Sig.	*t* (178)	*P*	Cohen's d	Lower	Upper
Equal variances assumed	1.284	.259	-.789	201	-.114	-1.9816	2.48425

The independent samples t-test reported in Table 3 examined sex differences in teachers' perceptions of differentiated assessment (PCDA). Levene's test indicated homogeneity of variances, F(1, 178) = 1.28, p =.26, so the "equal variances assumed" row is appropriate. The t-test itself was nonsignificant, t(178) = 0.79, p =.20, indicating that male and female teachers did not differ reliably in PCDA scores. The effect size was minimal (Cohen's d = 0.11), and the 95 % confidence interval for the mean difference ranged from –1.98 to 0.16, a span that includes zero. Concurrently, these statistics suggest that sex does not have a meaningful impact on teachers' perception of differentiated assessment. Hence, the study fails to reject the null hypothesis " H0: Sex has no statistically significant impact on PMT's perception of differentiated assessment."

H0: Educational level has no statistically significant influence on PMT's perception of differentiated assessment.

Table 4 summarises the descriptive statistics of PMTs perceived competence in differentiated assessment (PCDA) scores across four educational levels (Level 100, 200, 300 and 400) for a total sample of 203 PMTs. The overall mean PCDA score is M = 96.01 (SD = 17.39), indicating a generally positive perception of differentiated assessment among participants.

Table 4. Descriptive Statistics of PMT's Educational Level (N = 203)

PCDA	N	Mean	Std. Deviation	Std. Error
Level 100	37	100.2703	14.85981	2.44294
Level 200	79	94.1646	18.09975	2.03638
Level 300	58	98.1897	13.88228	1.82283
Level 400	29	91.2759	22.91428	4.25507
Total	203	96.0148	17.38540	1.22022

The results displayed in Table 4 reveal variations across the respective levels. Level 100 (n = 37) exhibited the highest mean score (M = 100.27, SD = 14.86), suggesting that freshmen demonstrated a favourable perception about differentiated assessment. Conversely, level 400 (n = 29) recorded the lowest mean (M = 91.28, SD = 22.91), suggesting that the majority of final-year students are less likely to support or incorporate differentiated assessment in their lessons. Levels 200 and 300 fall between these extremes, with means of 94.16 (SD = 18.10) and 98.19 (SD = 13.88), respectively. It is also evident that the standard error decreases as group size increases, revealing greater precision in the mean estimates for levels 200 and 300. These patterns suggest a potential inverse relationship between teaching experience (as indexed by educational level) and the perceived utility of differentiated assessment. Notably, the overlapping standard deviations suggest substantial within-group variability. These discoveries necessitated the application of inferential statistics, namely one-way ANOVA, to assess the statistical reliability of the reported differences.

Assumptions for the use of inferential statistics

Table 5 presents the results of Levene's test for equality of variances, which assesses whether the variability of PMTs' Perceived Competence in Differentiated Assessment (PCDA) scores differs across the four educational-level groups (Level 100, 20, 300, 400; N = 203). Homogeneous variances are a prerequisite for parametric comparisons such as one-way ANOVA. Hence, the confirmation of this assumption is essential before testing the primary hypothesis that educational level influences teachers' perception of differentiated assessment.

Table 5. Assessing the Normality of PMT's Educational Level and their Perception of Differentiated Assessment via Levene's Test of Equality of Variances (N = 203)

		Levene Statistic	df1	df2	Sig.
PCDA	Based on Mean	2.460	3	199	.064
	Based on Median	1.508	3	199	.214
	Based on Median and with adjusted df	1.508	3	169.449	.214
	Based on trimmed mean	2.070	3	199	.105

All significance values displayed in Table 4 exceed the conventional $\alpha = .05$ threshold, implying that the assumption of homogeneity of variances is satisfied (Levene's test statistic = 2.46, df = 3, $p > .05$). The persistent non-significant value across the four Levene's formulations (mean, median, median with adjusted df and trimmed mean) implies that PMT's perceived competency in differentiated assessment falls within robust to modest departures from normality. Therefore, it strengthens confidence in the execution of the one-way ANOVA test.

Table 6. One-Way Analysis of Variance on PMT's Educational Level and their Perception of Differentiated Assessment

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1866.091	3	622.030	2.091	.103
Within Groups	59188.865	199	297.431		
Total	61054.956	202			

Table 6 presents the results of a one-way analysis of variance carried out to test the null hypothesis that educational level does not influence PMTs perception of differentiated assessment. The statistic examines whether PMTs perceived competence in differentiated assessment differs significantly across these levels (levels: 100, 200, 300 and 400). The between-groups sum of squares (1866.091) reflects variability attributable to educational level, whereas the within-groups sum of squares (59188.865) captures residual variation among teachers within the same level. The computed F-ratio of (3,199) = 2.09 yields a significance value of p = 0.103. Since the p-value exceeds the conventional alpha level of .05, the null hypothesis was not rejected.

H0: Programme of study has no statistically significant impact on PMT's perception of differentiated assessment.

Descriptive statistics were computed to examine whether PMTs' perception of differentiated assessment varied across their programme of study. As shown in Table 7, the overall mean score for the study's sample (N = 203) was relatively high (M = 96.01, SD = 17.39), indicating that PMTs generally hold a positive perception of differentiated assessment.

Table 7. Descriptive Statistics of PMT's Programmes of Study

	N	Mean	Std. Deviation	Std. Error
ECE	40	95.9250	21.83550	3.45250
Primary	99	95.1414	16.83656	1.69214
J.H.S	64	97.4219	15.15927	1.89491
Total	203	96.0148	17.38540	1.22022

Across the three programmes, as displayed in the above table, the mean scores were comparable. PMTs in Early Childhood Education (ECE) recorded a mean of 95.93 (SD = 21.84), Primary Education recorded a mean of 95. 14 (SD = 16.84) and Junior High School recorded a comparatively higher mean of 97.42 (SD = 15.16). Though the J.H.S. group revealed a marginally higher perception score, the differences among the three groups were negligible. This observation is consistent with the substantial overlap in the precision of the standard error estimates. Although the descriptive results revealed meaningful variations in perceived competence based on the programme of study, the execution of inferential statistics will help shed light on the significance level of the variation.

Assumption for the use of inferential statistics

Table 8 presents the result of Levene's test for equality of variances, which assesses the variability of PMTs' perception of Differentiated assessment across their respective programmes of study (J.H.S, Primary, Early Childhood Education; N = 203). The test of homogeneity of variance is sine qua non of most inferential statistics, one-way ANOVA in particular.

Table 8. Assessing the Normality of PMT's Programmes of Study and their Perception of Differentiated Assessment via Levene's Test of Equality of Variances (N = 203)

		Levene Statistic	df1	df2	Sig.
PCDA	Based on Mean	.976	2	200	.379
	Based on Median	.669	2	200	.513
	Based on Median and with adjusted df	.669	2	174.729	.514
	Based on trimmed mean	.746	2	200	.476

None of the significant values displayed in Table 8 exceeds the conventional $\alpha = .05$ threshold, indicating that the assumption of homogeneity of variances is realised (Levene's test statistic = .976, df = 2, $p > .05$). The persistent non-significant value across the three Levene's formulations (mean, median, median and with adjusted df and based on trimmed mean) suggest that PMT's perceived competence in differentiated assessment falls withing robust to modest depatures from mormality. Hence, it strengthens confidence in the execution of the one-way ANOVA statistical test.

Table 9. One-Way Analysis of Variance on PMT's Educational Level and their Perception of Differentiated Assessment

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	202.551	2	101.276	.333	.717
Within Groups	60852.405	200	304.262		
Total	61054.956	202			

Table 9 presents the one-way ANOVA statistical test that examines the effect of PMTs educational level on their perception of differentiated assessment. The between-groups sum of squares was 202.551 with 2 df, yielding a mean square of 101.276. The within-groups sum of squares was 60852.405 with 200 df and a mean square of 304.262. The analysis reveals no statistically significant difference among PMTs' educational levels, $F(2, 200) = 0.333$, $p = 0.717$. The mean score for the between-groups (101.276) is

comparatively smaller than the within-groups mean square (304.262), implying that variation in perception scores occurs only within educational levels and not between them. In all, the findings revealed that educational level does not significantly influence PMTs' perception of differentiated assessment in the study sample.

Discussion

The findings of this study revealed that preservice mathematics teachers generally demonstrated positive perceptions toward differentiated assessment. This outcome suggests that future mathematics teachers increasingly recognize assessment not merely as a grading mechanism but as an instructional process capable of supporting diverse learner needs. Such perceptions reflect the growing influence of inclusive and learner-centered pedagogical frameworks within teacher education programmes. From a theoretical perspective, the findings support culturally responsive teaching theory, which emphasizes the importance of instructional and assessment practices that accommodate students' sociocultural and learning differences. The results also align with Bandura's self-efficacy theory, particularly the assumption that positive beliefs about instructional competence influence teachers' readiness to implement innovative classroom practices. Similar findings were reported by (Demo et al., 2021; Onyishi & Sefotho, 2021), who found that differentiated instructional approaches contribute positively to inclusive mathematics learning environments. However, unlike earlier studies that focused primarily on differentiated instruction broadly, the present study extends the discussion specifically to differentiated assessment, thereby contributing a more assessment-centered perspective to the literature on mathematics teacher education.

Another important finding concerns participants' strong belief that differentiated assessment promotes fairness, inclusion, and learner confidence in mathematics education. Conceptually, this perception reflects a shift from standardized assessment orientations toward more flexible and equitable approaches to evaluating learning outcomes. Mathematics classrooms are often characterized by substantial differences in students' readiness, learning pace, and problem-solving abilities; therefore, differentiated assessment may reduce inequities created by uniform testing practices. This finding supports the argument advanced by Töllner et al. (2025) that formative and differentiated assessment practices improve student participation and reduce exclusion within mathematics classrooms. Likewise, Bobis et al. (2021) emphasized that varied assessment strategies strengthen students' opportunities to demonstrate mathematical understanding through multiple pathways. The present study also reinforces the work of Alam & Mohanty (2023), who argued that differentiated assessment encourages educational equity by accommodating learners' diverse abilities and backgrounds. Nevertheless, the current findings appear to challenge traditional assessment assumptions that standardized procedures alone ensure fairness. Instead, the study suggests that fairness in mathematics assessment may be better understood as responsiveness to learner diversity rather than strict uniformity of assessment methods.

The study further revealed that participants perceived themselves as relatively prepared to implement differentiated assessment strategies in future mathematics classrooms. This finding is particularly significant because perceived readiness often predicts actual classroom behavior and willingness to adopt innovative pedagogical practices. From the perspective of self-efficacy theory, teachers who believe in their capability to design flexible assessments are more likely to persist when encountering instructional challenges. The result corresponds with the findings of Pan (2023), who found that teachers' confidence in their instructional competence positively influences their implementation of learner-centered teaching strategies. Similarly, Ji et al. (2022) reported that assessment-oriented professional preparation improves teachers' instructional responsiveness and classroom decision-making. However, although participants expressed confidence in general assessment adaptation, their responses regarding the design of tasks with multiple entry points were comparatively moderate. This suggests that theoretical understanding alone may not automatically translate into sophisticated assessment design competence. Consequently, teacher education programmes may need to

provide more practice-oriented training experiences that bridge the gap between conceptual awareness and classroom application.

Despite the generally positive perceptions observed, the findings also identified several challenges associated with implementing differentiated assessment, particularly time constraints, limited resources, and large class sizes. These challenges indicate that favorable attitudes toward differentiated assessment do not necessarily eliminate structural and contextual barriers within educational environments. In practice, mathematics teachers may struggle to develop multiple forms of assessment while simultaneously managing curricular demands and diverse classroom needs. This finding is consistent with Dack & Ann Tomlinson (2025), who observed that teachers frequently encounter logistical and institutional obstacles when attempting to implement differentiated instructional approaches. Similarly, Gibbs & McKay (2021) argued that differentiated practices require substantial planning, pedagogical flexibility, and institutional support to be implemented effectively. The current findings also support Meutstege et al. (2023), who emphasized that successful differentiation in mathematics education depends heavily on continuous assessment support, resources, and professional collaboration. However, the persistence of these barriers suggests that teacher readiness alone is insufficient unless accompanied by systemic support mechanisms within schools and teacher preparation institutions. Therefore, improving differentiated assessment practices may require broader educational reforms rather than relying solely on individual teacher competence.

The absence of statistically significant differences based on sex provides another important insight into preservice mathematics teachers' perceptions of differentiated assessment. This finding suggests that positive perceptions toward differentiated assessment are relatively consistent across male and female participants. Conceptually, this uniformity may indicate that contemporary teacher education programmes increasingly expose students to similar pedagogical philosophies and inclusive instructional approaches regardless of gender differences. The finding aligns with prior studies reporting that attitudes toward differentiated instruction are often shaped more strongly by professional training experiences than by demographic characteristics (Bi et al., 2023). Nevertheless, the current result differs slightly from some earlier studies that reported gender-related variations in teachers' instructional confidence and assessment practices. One possible explanation for this discrepancy may be the shared institutional context of the participants, which likely reduced variability in professional experiences and pedagogical exposure. Additionally, the growing integration of inclusive education principles within teacher education curricula may have contributed to more homogeneous perceptions among future teachers. Consequently, the findings imply that differentiated assessment may be increasingly perceived as a universal pedagogical responsibility rather than a practice influenced by gender-based professional orientations.

Similarly, the findings demonstrated that educational level did not significantly influence participants' perceptions of differentiated assessment. Although descriptive statistics indicated slight variations across levels, these differences were not statistically meaningful. This outcome suggests that exposure to teacher education coursework alone may not substantially alter perceptions unless accompanied by extensive practical engagement with differentiated assessment practices. The finding partly contrasts with studies suggesting that advanced educational experience strengthens pedagogical competence and assessment literacy (Xu et al., 2024). However, it also supports research indicating that perceptions of differentiated instruction often remain stable when practical classroom application opportunities are limited (Al-Shaboul et al., 2021). One plausible interpretation is that participants across all educational levels shared relatively similar instructional experiences within the institution, resulting in comparable attitudes toward assessment differentiation. Furthermore, the finding raises critical questions regarding the extent to which teacher education programmes progressively deepen students' understanding of differentiated assessment as they advance academically. This implies that differentiated assessment training may need to be embedded more explicitly and systematically across different levels of teacher preparation programmes rather than being introduced superficially.

The study also found no statistically significant differences in perceptions based on programme of study, indicating that preservice teachers from Early Childhood Education, Primary Education, and Junior High School Education programmes held relatively similar views regarding differentiated assessment. This finding suggests that the institutional culture and shared pedagogical training may exert stronger influence on assessment perceptions than programme specialization itself. From a theoretical standpoint, the result reinforces the notion that inclusive assessment principles are increasingly viewed as foundational competencies applicable across educational contexts rather than subject-specific practices. Comparable findings were reported by Niemi (2021), who emphasized that equitable assessment practices are becoming central to broader educational reform discussions internationally. Nevertheless, the lack of programme-based differences may also indicate insufficient differentiation in how assessment training is contextualized for specific educational levels. For instance, assessment approaches suitable for early childhood learners may differ considerably from those required in junior high mathematics classrooms. Therefore, while the findings demonstrate consistency in general perceptions, they simultaneously suggest the need for more contextualized and programme-specific preparation in differentiated assessment practices.

Overall, the present study contributes to the global literature on differentiated assessment by demonstrating that preservice mathematics teachers generally hold favorable perceptions toward inclusive assessment practices despite existing contextual challenges. More importantly, the findings extend current theoretical discussions by showing that positive perceptions alone do not guarantee effective implementation without adequate institutional support, practical training, and resource availability. The study therefore contributes conceptually by positioning differentiated assessment as both a pedagogical and structural issue within mathematics education. In contrast to previous studies that primarily emphasized instructional differentiation, this research foregrounds assessment as a central component of equitable mathematics teaching. The findings also highlight the importance of integrating assessment literacy, self-efficacy development, and culturally responsive pedagogy within teacher education curricula. Within the broader international literature, the study provides evidence from a developing educational context that remains underrepresented in differentiated assessment research. Consequently, the research not only addresses existing gaps in the literature but also offers a broader perspective on how future mathematics teachers conceptualize assessment equity within increasingly diverse learning environments.

Implications

The findings of this study suggest that differentiated assessment should be positioned as an essential component of mathematics teacher education because preservice teachers generally recognize its value in promoting inclusive and equitable learning. Nevertheless, the challenges identified in relation to instructional time, assessment design, and classroom management indicate that positive perceptions alone may not be sufficient to ensure effective classroom implementation. Teacher education programmes therefore need to move beyond theoretical discussions by providing sustained practical experiences that allow future teachers to design, adapt, and evaluate differentiated assessment strategies within authentic learning contexts. The study also highlights the importance of integrating assessment literacy, culturally responsive pedagogy, and reflective teaching practices into preservice teacher preparation. In addition, educational institutions and policymakers should provide supportive learning environments, professional mentoring, and digital assessment resources that strengthen teachers' confidence and instructional flexibility in addressing diverse learner needs in mathematics classrooms.

Limitations

This study has several limitations that should be considered when interpreting the findings. The research relied primarily on self-reported questionnaire responses, which may not fully represent participants' actual classroom practices or competencies in implementing differentiated assessment. The use of a cross-sectional survey design also limited the ability to observe how perceptions may develop

over time through teaching experience and professional training. Furthermore, the study was conducted within a single College of Education in Ghana, which may reduce the generalizability of the findings to other institutional or cultural contexts. Although the quantitative approach provided measurable patterns of perception, it did not allow for deeper exploration of participants' personal experiences, instructional challenges, or contextual realities related to differentiated assessment practices.

Suggestions

Future studies should consider employing longitudinal and mixed-methods approaches to gain a more comprehensive understanding of how preservice mathematics teachers develop competence and confidence in differentiated assessment over time. Incorporating interviews, classroom observations, and reflective teaching portfolios may provide richer insights into the practical realities of assessment implementation beyond self-reported perceptions. It is also recommended that future research involve participants from multiple institutions and educational settings to enhance the broader applicability of findings across diverse contexts. From a practical standpoint, teacher education institutions should strengthen assessment training through authentic classroom simulations, mentorship opportunities, and technology-supported assessment workshops that help future teachers translate theoretical understanding into effective instructional practice.

Conclusion

This study concludes that preservice mathematics teachers generally perceive differentiated assessment as a meaningful and supportive approach for enhancing fairness, inclusion, and student engagement in mathematics learning. The findings indicate that future teachers increasingly acknowledge the importance of adapting assessment practices to accommodate learners' diverse abilities, needs, and learning profiles. Although participants demonstrated positive attitudes toward differentiated assessment, several practical concerns, including limited instructional time, insufficient resources, and challenges in designing flexible assessment tasks, remain significant barriers to effective implementation. The study also found that perceptions of differentiated assessment were relatively consistent across sex, educational level, and programme of study, suggesting that awareness of inclusive assessment practices is becoming widely shared among preservice teachers. These findings highlight the importance of strengthening practical assessment training within teacher education programmes so that future mathematics teachers can effectively translate conceptual understanding into classroom practice. Overall, the study reinforces the view that differentiated assessment is not only an instructional strategy but also an important pathway toward more equitable and responsive mathematics education.

Author Contributions Statement

Atar Alphaa Mohammed conceptualized the study, designed the research methodology, developed the research instrument, supervised data collection, conducted the statistical analysis, and drafted the original manuscript. Nicholas Essien contributed to the literature review, validation of the research instrument, data interpretation, and critical revision of the manuscript for important intellectual content. Gabina Susuoraka contributed to the research design, interpretation of findings, manuscript editing, proofreading, and overall supervision of the study. All authors read and approved the final version of the manuscript prior to submission.

References

Abel, V. R., Tondeur, J., & Sang, G. (2022). *Teacher Perceptions about ICT Integration into Classroom Instruction*. Education Sciences, 12(9), 609. https://doi.org/10.3390/educsci12090609

Aguilera, R. V., De Massis, A., Fini, R., & Vismara, S. (2024). *Organizational Goals, Outcomes, and the Assessment of Performance: Reconceptualizing Success in Management Studies*. Journal of Management Studies, 61(1), 1–36. https://doi.org/10.1111/joms.12994

Alam, A., & Mohanty, A. (2023). *Cultural beliefs and equity in educational institutions: Exploring the social and philosophical notions of ability groupings in teaching and learning of mathematics*. International Journal of Adolescence and Youth, 28(1), 2270662. https://doi.org/10.1080/02673843.2023.2270662

Al-Shaboul, Y., Al-Azaizeh, M., & Al-Dosari, N. (2021). *Differentiated Instruction between Application and Constraints: Teachers' Perspective*. European Journal of Educational Research, 10(1), 127–143.

Babbar, M., & Gupta, T. (2022). *Response of educational institutions to COVID-19 pandemic: An inter-country comparison*. Policy Futures in Education, 20(4), 469–491. https://doi.org/10.1177/14782103211021937

Barbier, K., Struyf, E., Verschueren, K., & Donche, V. (2023). *Fostering cognitive and affective-motivational learning outcomes for high-ability students in mixed-ability elementary classrooms: A systematic review*. European Journal of Psychology of Education, 38(1), 83–107. https://doi.org/10.1007/s10212-022-00606-z

Bi, M., Struyven, K., & Zhu, C. (2023). *Variables that influence teachers' practice of differentiated instruction in Chinese classrooms: A study from teachers' perspectives*. Frontiers in Psychology, 14. https://doi.org/10.3389/fpsyg.2023.1124259

Bobis, J., Russo, J., Downton, A., Feng, M., Livy, S., McCormick, M., & Sullivan, P. (2021). *Instructional Moves that Increase Chances of Engaging All Students in Learning Mathematics*. Mathematics, 9(6), 582. https://doi.org/10.3390/math9060582

Cevikbas, M., & Kaiser, G. (2022). *Student Engagement in a Flipped Secondary Mathematics Classroom*. International Journal of Science and Mathematics Education, 20(7), 1455–1480. https://doi.org/10.1007/s10763-021-10213-x

Dack, H., & Ann Tomlinson, C. (2025). *Preparing Novice Teachers to Differentiate Instruction: Implications of a Longitudinal Study*. Journal of Teacher Education, 76(1), 12–28. https://doi.org/10.1177/00224871241232419

Demo, H., Garzetti, M., Santi, G., & Tarini, G. (2021). *Learning Mathematics in an Inclusive and Open Environment: An Interdisciplinary Approach*. Education Sciences, 11(5), 199. https://doi.org/10.3390/educsci11050199

Endale, D., Tadesse, A., Admasu, A., & Getachew, A. (2024). *University teachers' underlying assumptions about assessment in English as a foreign language context in Ethiopia*. Cogent Education, 11(1), 2335748. https://doi.org/10.1080/2331186X.2024.2335748

Gibbs, K., & McKay, L. (2021). *Differentiated teaching practices of Australian mainstream classroom teachers: A systematic review and thematic analysis*. International Journal of Educational Research, 109, 101799. https://doi.org/10.1016/j.ijer.2021.101799

Grecu, Y. V. (2023). *Differentiated instruction: Curriculum and resources provide a roadmap to help English teachers meet students' needs*. Teaching and Teacher Education, 125, 104064. https://doi.org/10.1016/j.tate.2023.104064

Herner-Patnode, L., & Lee, H.-J. (2021). *Differentiated Instruction to Teach Mathematics: Through the Lens of Responsive Teaching*. Mathematics Teacher Education and Development, 23(3), 6–25.

Ji, X., Cao, Y., & Wei, W. (2022). *Pre-service teachers' pedagogical decisions on integrated-skills instruction in a sojourn Chinese teaching programme: The context matters*. Cogent Education, 9(1), 2064602. https://doi.org/10.1080/2331186X.2022.2064602

Lindner, K.-T., & Schwab, S. (2025). *Differentiation and individualisation in inclusive education: A systematic review and narrative synthesis*. International Journal of Inclusive Education, 29(12), 2199–2219. https://doi.org/10.1080/13603116.2020.1813450

Lo, C. K., & Hew, K. F. (2021). *Developing a flipped learning approach to support student engagement: A design-based research of secondary school mathematics teaching*. Journal of Computer Assisted Learning, 37(1), 142–157. https://doi.org/10.1111/jcal.12474

Meutstege, K., Van Geel, M., & Visscher, A. (2023). *Evidence-Based Design of a Teacher Professional Development Program for Differentiated Instruction: A Whole-Task Approach*. Education Sciences, 13(10), 985. https://doi.org/10.3390/educsci13100985

Mir, A. H. (2025). *LEARNER-CENTERED PEDAGOGIES: TRANSFORMING EDUCATION FOR THE 21ST CENTURY*. Journal of Accounting Research, Utility Finance and Digital Assets, 3(4), 383–387. https://doi.org/10.54443/jaruda.v3i4.217

Morris, R., Perry, T., & Wardle, L. (2021). *Formative assessment and feedback for learning in higher education: A systematic review*. Review of Education, 9(3), e3292. https://doi.org/10.1002/rev3.3292

Niemi, H. (2021). *Education Reforms for Equity and Quality: An Analysis from an Educational Ecosystem Perspective with Reference to Finnish Educational Transformations*. Center for Educational Policy Studies Journal, 11(2), 13–35.

Obrovská, J., Svojanovský, P., Kratochvílová, J., Lojdová, K., Tůma, F., & Vlčková, K. (2024). *Promises and challenges of differentiated instruction as pre-service teachers learn to address pupil diversity*. Journal of Education for Teaching, 50(3), 403–420. https://doi.org/10.1080/02607476.2023.2247356

Onyishi, C. N., & Sefotho, M. M. (2021). *Differentiating instruction for learners' mathematics self-efficacy in inclusive classrooms: Can learners with dyscalculia also benefit?* South African Journal of Education, 41(4), 1–15. https://doi.org/10.15700/saje.v41n4a1938

Pan, H.-L. W. (2023). *Learner-Centered Teaching Catalyzed by Teacher Learning Communities: The Mediating Role of Teacher Self-Efficacy and Collaborative Professional Learning*. Sustainability, 15(6), 4850. https://doi.org/10.3390/su15064850

Ramaila, S. (2025). *Unveiling the Potential: A Systematic Review on Harnessing the Affordances of Differentiated Instruction*. Journal of Teaching and Learning, 19(2), 41–56. https://doi.org/10.22329/jtl.v19i2.8561

Subandiyah, H., Nasrullah, R., Ramadhan, R., Supratno, H., Raharjo, R. P., & Lukman, F. (2025). *The impact of differentiated instruction on student engagement and achievement in Indonesian language learning*. Cogent Education, 12(1), 2516378. https://doi.org/10.1080/2331186X.2025.2516378

Töllner, F., Kuhl, P., & Besser, M. (2025a). *Formative Assessment in Inclusive Mathematics Education in Secondary Schools: A Systematic Review*. Education Sciences, 15(5), 577. https://doi.org/10.3390/educsci15050577

Töllner, F., Kuhl, P., & Besser, M. (2025b). *Formative Assessment in Inclusive Mathematics Education in Secondary Schools: A Systematic Review*. Education Sciences, 15(5), 577. https://doi.org/10.3390/educsci15050577

van den Kieboom, L. A., & Groleau, S. V. (2022). *Pre-service teacher planning for differentiation of instruction in mathematics classrooms*. Educational Studies in Mathematics, 111(2), 225–252. https://doi.org/10.1007/s10649-022-10149-1

Vidergor, H. E. (2023). *The effect of teachers' self- innovativeness on accountability, distance learning self-efficacy, and teaching practices*. Computers & Education, 199, 104777. https://doi.org/10.1016/j.compedu.2023.104777

Xu, J., Zhang, S., & Chen, H. (2024). *The impact of teacher autonomy support on students' assessment literacy: The chain mediating effects of self-efficacy and critical reflection*. Heliyon, 10(14). https://doi.org/10.1016/j.heliyon.2024.e34616

Zaier, A., & Maina, F. (2022). *Assessing Preservice Teachers' Perceptions and Practices to Differentiate Instruction for Culturally and Linguistically Diverse Students in Secondary Classrooms*. International Journal of Multicultural Education, 24(2), 1–16.

Ziernwald, L., Hillmayr, D., & Holzberger, D. (2022). *Promoting High-Achieving Students Through Differentiated Instruction in Mixed-Ability Classrooms—A Systematic Review*. Journal of Advanced Academics, 33(4), 540–573. https://doi.org/10.1177/1932202X221112931