

# Elementary School Teacher's Competence in Implementing Differentiated Learning in Surakarta City

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**Abstract:** In elementary schools, differentiated learning is crucial as this phase is a critical period for establishing fundamental learning and child development. Differentiated learning aims not only to improve academic outcomes but also to develop students' social and emotional skills. The findings are expected to offer concrete recommendations for developing more effective teacher training programs and educational policies that support differentiated learning, enhancing education quality and student learning outcomes in elementary schools. This study evaluates elementary school teachers' competencies in implementing differentiated learning in Surakarta. A survey research design was used to collect data on teachers' abilities to plan, implement, and evaluate differentiated learning. Using a quantitative approach, the study involved 214 teachers randomly selected from various elementary schools in Surakarta. The distributed questionnaire collected data on knowledge, skills, and differentiated learning practices. The collected data were analyzed using descriptive statistical analysis with SPSS software. The results reveal variation in teacher competencies, with strengths primarily in using differentiated learning media and practice reflection, while the greatest challenges are in assessing student learning progress and implementing strategies. These findings highlight the need for additional training and support to enhance the effectiveness of differentiated learning implementation in elementary schools.

**Keywords:** Differentiated instruction; Elementary school; Teacher

## Introduction

Differentiated learning has emerged as one of the most emphasized pedagogical approaches in recent decades, particularly in efforts to meet the diverse learning needs of students (Langelaan et al., 2024; Ojong, 2023; Ahmad et al., 2024). This approach aims to tailor instruction to various levels of ability, interests, and learning styles, enabling each student to reach their academic potential (Oskarsson & Johansson, 1987; Eikeland & Ohna, 2022). Globally, many education systems have adopted differentiated learning as a key strategy to enhance inclusivity and learning effectiveness (Lindner & Schwab, 2020; Tupiño et al., 2023). In Indonesia, the application of differentiated

learning is gaining attention, aligned with government efforts to improve the quality of basic education more equitably. The concept of differentiated learning is rooted in progressive education theories that stress treating students as unique individuals (Hasanah et al., 2022). Theoretical foundations like Howard Gardner's multiple intelligences theory and Jean Piaget's constructivism (Umayrah et al., 2024), have provided strong theoretical bases for this approach. Differentiated learning aims not only to improve academic outcomes but also to develop student's social and emotional skills (Alsalmi et al., 2021; Sapan & Mede, 2022). In elementary schools, differentiated learning is crucial as this phase is a critical period for establishing fundamental learning

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and child development (Astuti & Afendi, 2022; Partami, 2019).

However, implementing differentiated learning in elementary schools faces several challenges (Gibbs, 2023; Suryati et al., 2023; Yuen et al., 2023), one of which is teacher competence (Bestian & Rashid, 2024; Suprayogi et al., 2017). Teachers play a central role in designing and executing differentiated learning, yet many feel inadequately prepared and lack the necessary skills. Teacher competence includes understanding differentiated learning, analyzing student needs, designing diverse learning activities, implementing these designs, and evaluating the approaches' effectiveness (Smets & Struyven, 2020; Zoraloglu et al., 2022).

This study aims to comprehensively evaluate teachers' competencies in applying differentiated learning in elementary schools. The study hopes to provide an in-depth view of the challenges teachers face in implementing differentiated learning strategies and find practical solutions to overcome these barriers. Additionally, the findings are expected to offer concrete recommendations for developing more effective teacher training programs and educational policies that support differentiated learning, enhancing education quality and student learning outcomes in elementary schools. Recent literature reviews indicate that while there is considerable research on differentiated learning, most studies focus on its effectiveness from the students' perspective or learning outcomes specifically evaluating teachers' competencies in applying differentiated learning in elementary schools is relatively scarce. Existing studies often use quantitative or qualitative approaches separately, providing limited holistic insights into the challenges and factors affecting teacher competence.

This study will provide a more comprehensive and in-depth contribution to the existing literature. Additionally, focusing on the context of elementary

schools in Indonesia will offer relevant and practical insights for developing local education policies and practices. By critically identifying and analyzing gaps in the literature, this research emphasizes the importance of teacher competence in successfully implementing differentiated learning. It offers evidence-based recommendations for improving educational quality. This study offers a significant new contribution to education by focusing on the context of elementary schools in Indonesia. It provides a much-needed local perspective for developing relevant and effective educational policies and training programs.

**Method**

This study employs a survey research design to evaluate teachers' competencies in implementing differentiated learning in elementary schools. The survey collected data on teachers' abilities to plan, implement, and evaluate differentiated learning. A quantitative approach was chosen to allow systematic and measurable analysis of the studied variables. The population for this study includes all elementary school teachers in Surakarta. A sample of 214 respondents was randomly selected from various elementary schools. Simple random sampling was used to ensure adequate representation of the population. The research procedure began with approaching schools and teachers to obtain permission and cooperation for data collection. After approval, questionnaires were distributed to the selected teachers. Each questionnaire included clear instructions for completion and return within the specified time frame. The collected data were then analyzed using descriptive statistical analysis with SPSS software. Descriptive analysis was used to describe the studied variables' sample characteristics and response distribution. The aspects and indicators of the study that served as the basis for developing the research instrument are as follows.

**Table 1.** Research Instrument

Indicators	Items
Knowledge of Differentiated Learning	How well do you understand the concepts and principles of differentiated learning?
	To what extent do you know strategies for tailoring learning to student needs?
Skills in Designing Differentiated Learning Materials	How often do you plan activities that fit students' learning needs?
	How well do you design materials that match students' learning styles?
	How often do you apply differentiated strategies in daily teaching?
Implementation of Differentiated Strategies	To what extent do you adapt instructions and materials to meet different student needs?
Use of Differentiated Learning Media	How often do you use technology to support differentiated instruction?
	How well do you provide additional resources for students with varying skill levels?
Ability to Assess Student Learning Progress	How well do you assess the progress of students receiving differentiated learning?
	To what extent do you adjust evaluation methods to meet student needs?

Indicators	Items
Reflection and Improvement of Practice	How often do you reflect on and improve your differentiation approach based on student evaluations?
	How well do you adapt teaching strategies to enhance learning outcomes for students with different levels of success?

## Result and Discussion

### Respondent Demographics

This study involves a demographic analysis of the respondents to understand the characteristics of teachers participating in implementing differentiated learning in elementary schools in Surakarta City. The data includes gender, age, teaching experience, and educational level, providing valuable insights into the profile of teachers involved in this research.

**Table 2.** Respondent Demographics

Category	Forms	Number of Observation	Frequency (%)
Gender	Male	62	28.97
	Female	152	71.03
Age	20-25	13	6.07
	26-30	34	15.89
	31-35	31	14.49
	40-45	58	27.10
	46-50	52	24.30
Experience	51-55	26	12.15
	1-5	25	11.68
	6-10	29	13.55
	11-15	21	9.81
	16-20	49	22.90
Degree	21-25	46	21.50
	26-30	44	20.56
	Bachelor	184	85.98
	Master	30	14.02

Out of the total 214 teachers who participated in this study, most respondents were female (71.03%), indicating that women are more dominant in the elementary teaching profession in Surakarta City. The age of respondents varied, with most falling within the 40-45 years range (27.10%) and 46-50 years range (24.30%), suggesting that most teachers are in their mid-career stage. Regarding teaching experience, 22.90% of teachers had 16-20 years of experience, followed by 21.50% with 21-25 years of experience, indicating a relatively high level of experience among the respondents. Most teachers held a bachelor's degree (85.98%), while 14.02% held a master's degree, reflecting a fairly good level of education among elementary school teachers in the area. This data provides important context for evaluating teacher competencies in implementing differentiated instruction, as demographic factors such as gender, age, experience, and education can influence their approach to applying this strategy in the classroom.

### Teacher Competencies in Implementing Differentiated Instruction

This study analyzed six key indicators of teacher competencies in implementing differentiated instruction in Surakarta City. The collected data covers various aspects, from knowledge to the ability to reflect on practice. The following table presents the distribution of results for each indicator, providing an overview of the extent of teacher competence in each area.

**Table 3.** Teacher Competencies in Implementing Differentiated Instruction

Indicators	Category				
	5	4	3	2	1
Knowledge of Differentiated Learning	25	53	65	44	27
Skills in Designing Differentiated Learning	27	37	72	46	32
Implementation of Differentiated Learning	32	31	64	58	29
Use of Differentiated Learning Media	46	61	52	33	22
Ability to Assess Student Learning Progress	19	35	53	64	43
Reflection and Improvement of Practice	51	60	47	30	26

The table above shows the distribution of results from the six indicators used to evaluate teacher competencies in differentiated instruction. Each indicator reflects various aspects of teacher skills and knowledge, ranging from understanding differentiated instruction to the ability to reflect on and improve their practice. This data serves as the foundation for a detailed analysis of the strengths and areas needing improvement for each indicator. A detailed analysis will further explain the findings for each indicator, providing deeper insights into how teachers apply differentiated instruction in their practice.

### Knowledge of Differentiated Learning

The results reveal variations in the level of elementary school teachers' knowledge of differentiated instruction. A total of 25 teachers (11.68%) were rated as having outstanding knowledge of differentiated instruction. The largest group, consisting of 65 teachers (30.37%), was rated at a satisfactory level of knowledge, while 53 teachers (24.77%) reached a very satisfactory level. However, 44 teachers (20.56%) needed improvement in their understanding, and 27 teachers

(12.62%) were considered unsatisfactory in their mastery of this concept. This data reflects a wide distribution in teachers' understanding of differentiated instruction, with the majority at satisfactory to very satisfactory levels, but a significant proportion still requiring improvement.

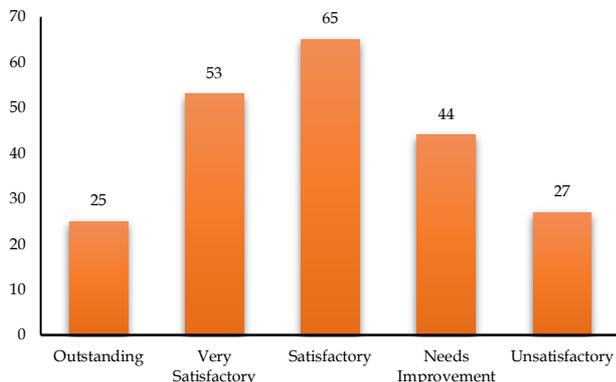


Figure 1. Knowledge of differentiated learning

Teachers' varied skills in designing differentiated learning materials underscores a critical need for targeted professional development. While many teachers demonstrate strong capabilities, a significant proportion who are less proficient highlights gaps that need addressing. This disparity suggests that while some teachers effectively create materials that cater to diverse learning needs, others may benefit from additional support and training. Research indicates that improving teachers' understanding and application of differentiated instruction is essential for creating an inclusive learning environment (Amoakwah & Donkoh, 2023; Jöhler & Krumsvik, 2022). To bridge this gap, it is essential to implement focused training programs that enhance material design skills. These programs should emphasize practical strategies and provide resources that enable teachers to develop more effective differentiated learning materials (Kyeremeh et al., 2022). By addressing these needs, educational institutions can ensure that all teachers have the tools and knowledge necessary to support diverse student learning requirements, ultimately fostering a more inclusive and effective educational environment.

#### Skills in Designing Differentiated Learning Materials

The data on teachers' skills in designing differentiated learning materials show significant variation. Of the 214 teachers surveyed, 27 (12.62%) possess outstanding skills, while 37 (17.29%) are rated very satisfactory. Most teachers were satisfactory, totaling 72 teachers (33.64%). However, 46 teachers (21.50%) were found to need improvement, and 32 teachers (14.95%) were considered unsatisfactory in

designing materials. This data suggests that while most teachers have adequate skills in designing materials, there is still a group of teachers who require additional support to improve their skills in this area.

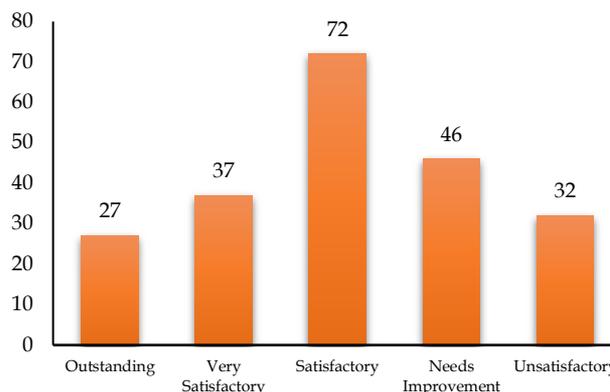


Figure 2. Skills in designing differentiated learning materials

Teachers' varied skills in designing differentiated learning materials underscore a critical need for targeted professional development. While many teachers demonstrate strong capabilities, the significant proportion who are less proficient highlights gaps that need addressing. This disparity suggests that while some teachers effectively create materials that cater to diverse learning needs, others may benefit from additional support and training. To bridge this gap, it is essential to implement focused training programs that enhance material design skills. These programs should emphasize practical strategies and provide resources for teachers to develop more effective differentiated learning materials. Research supports that targeted professional development and practical application of differentiated instruction can significantly improve teaching outcomes (Kholid et al., 2024; Moya & Tobar, 2019). By addressing these needs, educational institutions can ensure that all teachers have the tools and knowledge necessary to support diverse student learning requirements, ultimately fostering a more inclusive and effective educational environment.

#### Implementation of Differentiated Strategies

The data on the implementation of differentiated learning strategies reveal variations in the quality of application by teachers. 32 teachers (14.95%) were rated as having outstanding implementation skills, while 31 teachers (14.49%) demonstrated very satisfactory levels. Most teachers fell into the satisfactory category, with 64 teachers (29.91%). However, 58 teachers (27.11%) needed improvement, and 29 teachers (13.55%) were considered unsatisfactory in implementing these strategies. This data indicates that while most teachers

can implement the strategies adequately, a significant group requires further support.

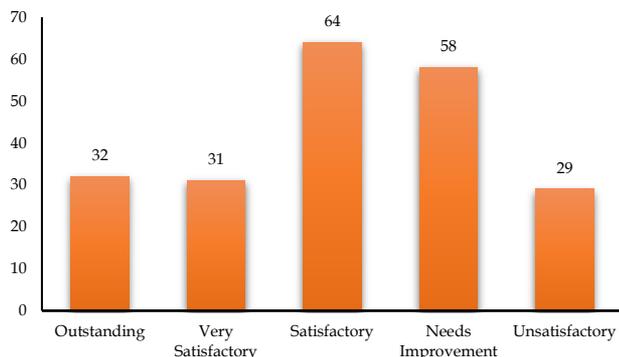


Figure 3. Implementation of Differentiated Strategies

These results highlight the importance of additional support in implementing differentiated learning strategies in the classroom. While some teachers have achieved a very high level of implementation, nearly one-third of respondents face difficulties that require improvement. The "Needs Improvement" and "Unsatisfactory" categories reflect challenges related to a lack of practical training or insufficient resources. To enhance the effectiveness of these strategies, ongoing training focused on practical applications and solutions to common challenges is necessary (Darling-Hammond et al., 2020). Mentoring programs and teacher collaboration can also help improve the application of strategies in practice (Onyishi & Sefotho, 2020; Arnsby et al., 2023). Addressing these challenges and providing appropriate support and resources will likely improve the quality of differentiated learning strategy implementation, thereby offering greater benefits to students with diverse needs (Haelermans, 2022).

*Use of Differentiated Learning Media*

The data on the use of differentiated learning media shows varying levels among teachers. A total of 46 teachers (21.50%) were rated as having outstanding media usage skills, and 61 teachers (28.50%) demonstrated very satisfactory levels. Most teachers fell into the satisfactory category, with 52 teachers (24.30%). However, 33 teachers (15.42%) were categorized as needing improvement, and 22 teachers (10.28%) were considered unsatisfactory in their media use. This data indicates that while many teachers are proficient in using learning media, there is still room for improvement in certain aspects (Dwivedi et al., 2023).

These results indicate that most teachers in Surakarta are fairly skilled in using differentiated learning media, with many achieving very satisfactory or outstanding levels. However, some teachers require improvement, particularly those in the "Needs

Improvement" and "Unsatisfactory" categories. The ability to select and use appropriate media is crucial in supporting various learning styles and student needs (Putra, 2023). Additional training focused on the selection, creation, and use of learning media can enhance these skills (Demir, 2021). Furthermore, sharing best practices and providing access to a diverse range of media resources can assist teachers in improving the effectiveness of media use in teaching (Haleem et al., 2022). By implementing these measures, the use of differentiated learning media is expected to become more effective, supporting better learning outcomes for all students.

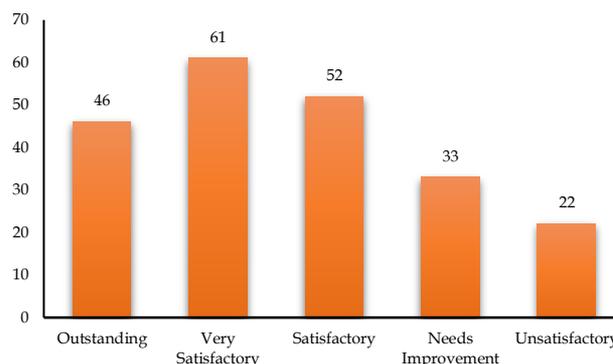


Figure 4. Use of differentiated learning media

*Ability to Assess Student Learning Progress*

The data on teachers' ability to assess student learning progress shows a variation in skill levels. A total of 19 teachers (8.88%) were rated as having outstanding assessment skills, while 35 teachers (16.36%) demonstrated very satisfactory levels. Most teachers fell into the satisfactory category, with 53 teachers (24.77%). However, 64 teachers (29.91%) were categorized as needing improvement, and 43 teachers (20.09%) were considered unsatisfactory in their assessment abilities. This data indicates that many teachers face challenges in effectively assessing student learning progress.

These results indicate that while several teachers can assess student learning progress very well, nearly half of the respondents face difficulties in this area. The "Needs Improvement" and "Unsatisfactory" categories reflect significant challenges in assessment skills, which are crucial for effective differentiated learning. The ability to accurately and fairly assess student progress is key to adjusting instruction and providing constructive feedback (Westbroek et al., 2020). Therefore, additional training in effective assessment techniques and the use of appropriate evaluation tools are essential. (Schildkamp et al., 2020; Estaji, 2024). Moreover, implementing a more structured assessment system and providing peer support in conducting evaluations can

enhance assessment quality (Double et al., 2020). By addressing these areas, it is anticipated that teachers will improve their ability to monitor and support the overall academic development of students.

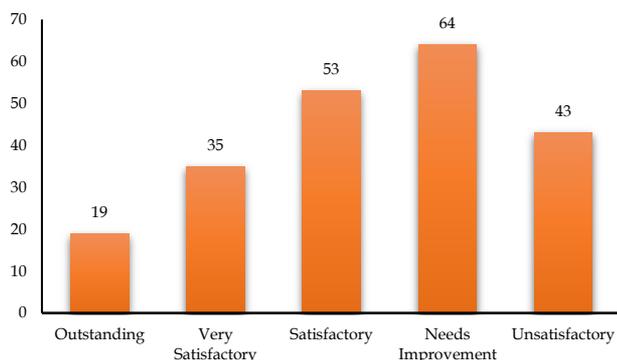


Figure 5. Ability to assess student learning progress

*Reflection and Improvement of Practice*

The data on reflection and improvement of teaching practices shows quite positive results. A total of 51 teachers (23.85%) were rated as having outstanding abilities in reflection and improvement of practice, while 60 teachers (27.97%) demonstrated very satisfactory levels. Most teachers fell into the satisfactory category, with 47 teachers (21.97%). However, 30 teachers (13.95%) were categorized as needing improvement, and 26 teachers (12.18%) were considered unsatisfactory in their reflection and improvement of practice. This data indicates that while many teachers demonstrate good reflection and improvement abilities, there are still some who need enhancement in this area.

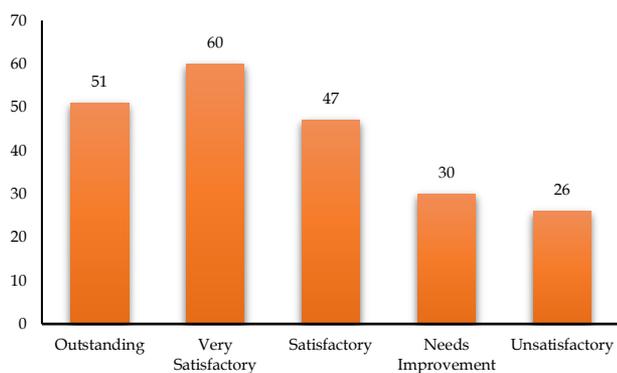


Figure 6. Reflection and improvement of practice

These results indicate that most teachers in Surakarta have strong abilities to reflect on and improve their teaching practices. The ability to critically evaluate and enhance instructional practices is key to professional growth and instructional effectiveness. However, many teachers fall into the "Needs Improvement" and "Unsatisfactory" categories,

highlighting the need for greater attention to developing reflective skills. To enhance these abilities, training programs that emphasize reflective techniques and constructive feedback could be highly beneficial. Implementing regular reflective activities, such as discussion groups or classroom-based supervision, can strengthen reflective practices (Chan & Lee, 2021). By providing additional support and resources to teachers who need improvement, it is expected that they can enhance their practices, which will, in turn, positively impact the quality of instruction and student learning outcomes (Lerang et al., 2021).

**Conclusion**

This study reveals that the competency of teachers in implementing differentiated learning in Surakarta varies significantly across different indicators. Overall, teachers demonstrated strengths in using differentiated learning media and in reflecting on and improving their practices, with many teachers falling into the "Very Satisfactory" or "Outstanding" categories. However, challenges arise in certain areas, particularly in assessing student learning progress and implementing differentiated learning strategies. The "Needs Improvement" and "Unsatisfactory" categories indicate an urgent need for additional training and better support. These findings underscore the importance of targeted interventions, including ongoing training focused on developing assessment skills and implementing differentiated strategies. Furthermore, providing adequate resources and evaluation tools can enhance the effectiveness of teaching. By addressing the identified strengths and weaknesses, educational policies and teacher training programs can be designed to support comprehensive competency improvement. This will not only improve teaching practices but also contribute to better and more inclusive learning outcomes for elementary school students.

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**Author Contributions**

S. I. and J. I. S. P. were responsible for the conceptualization of the study. S. I handled the methodology, while J. I. S. P. contributed to software usage. Validation was carried out by S. I., J. I. S. P., and S. M. S. I led the formal analysis, investigation, resources, data curation, and original draft preparation. S., managed writing—review, and editing, and S provided supervision and project administration. S. I secured funding for the research. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study, data collection, analysis, interpretation, manuscript writing, or decision to publish the results.

## References

- Ahmad, D. S., Hesmatantya, V., & Mayasari, L. (2024). Implementation of Differentiated Learning in English Lesson Using Independent Curriculum at MAN Surabaya. *Journal of Language, Communication, and Tourism*, 2(2), 1-11. <https://doi.org/10.25047/jlct.v2i2.50021>
- Asalhi, N. R., Abdelrahman, R., Abdelkader, A. F. I., Ahmad Al-Yatim, S. S., Habboush, M., & Qawasmi, A. Al. (2021). Impact of Using the Differentiated Instruction (DI) Strategy on Student Achievement in an Intermediate Stage Science Course. *International Journal of Emerging Technologies in Learning*, 16(11), 25-45. <https://doi.org/10.3991/ijet.v16i11.22303>
- Amoakwah, A., & Donkoh, S. (2023). Basic School Teachers' Knowledge and Use Of Differentiated Instruction. *European Journal of Education Studies*, 10(10). <https://doi.org/10.46827/ejes.v10i10.5004>
- Anggoro, S., Fitriati, A., Thoe, N. K., Talib, C. A., & Mareza, L. (2024). Differentiated instruction based on multiple intelligences promises joyful and meaningful learning. *International Journal of Evaluation and Research in Education (IJERE)*, 13(2), 1194. <https://doi.org/10.11591/ijere.v13i2.24791>
- Arnsby, E. S., Aspors, J., & Jacobsson, K. (2023). Teachers' professional learning through mentor education: A longitudinal mixed-methods study. *Education Inquiry*, 1-20. <https://doi.org/10.1080/20004508.2023.2273019>
- Astuti, I., & Afendi, A. R. (2022). Implementation of Differentiated Learning Through Play Activities in Early Childhood. *EduLine: Journal of Education and Learning Innovation*, 2(3), 358-365. <https://doi.org/10.35877/454ri.eduline1264>
- Bastian, B., & Mohd Rashid, S. M. (2024). Remedial Education Teachers' Competencies for Differentiated Pedagogy: Systematic Literature Review. *International Journal of Learning, Teaching and Educational Research*, 23(1), 427-444. <https://doi.org/10.26803/ijlter.23.1.21>
- Chan, Cecilia, K. Y., & Lee, K. K. W. (2021). Reflection literacy: A multilevel perspective on the challenges of using reflections in higher education through a comprehensive literature review. *Educational Research Review*, 32, 100376. <https://doi.org/10.1016/j.edurev.2020.100376>
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97-140. <https://doi.org/10.1080/10888691.2018.1537791>
- Demir, S. (2021). The Impact of Differentiated Instructional Media on the Motivation and Opinions of Students towards Science Learning in Terms of Learning Styles. *Shanlax International Journal of Education*, 9(3), 16-25. <https://doi.org/10.34293/education.v9i3.3723>
- Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020). The Impact of Peer Assessment on Academic Performance: A Meta-analysis of Control Group Studies. *Educational Psychology Review*, 32(2), 481-509. <https://doi.org/10.1007/s10648-019-09510-3>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koochang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., ... Wright, R. (2023). Opinion Paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges, and implications of generative conversational AI for research, practice, and policy. *International Journal of Information Management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- Eikeland, I., & Ohna, S. E. (2022). Differentiation in education: A configurative review. *Nordic Journal of Studies in Educational Policy*, 8(3), 157-170. <https://doi.org/10.1080/20020317.2022.2039351>
- Estaji, M. (2024). Perceived need for a teacher education course on assessment literacy development: Insights from EAP instructors. *Asian-Pacific Journal of Second and Foreign Language Education*, 9(1), 50. <https://doi.org/10.1186/s40862-024-00272-2>
- Gibbs, K. (2023). Voices in practice: Challenges to implementing differentiated instruction by teachers and school leaders in an Australian mainstream secondary school. *The Australian Educational Researcher*, 50(4), 1217-1232. <https://doi.org/10.1007/s13384-022-00551-2>
- Haelermans, C. (2022). The Effects of Group differentiation on students' learning strategies. *Instructional Science*, 50(2), 223-250. <https://doi.org/10.1007/s11251-021-09575-0>
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and*

- Computers*, 3, 275–285. <https://doi.org/10.1016/j.susoc.2022.05.004>
- Hasanah, E., Suyatno, S., Maryani, L., Badar, M. I. A., Fitria, Y., & Patmasari, L. (2022). Conceptual Model of Differentiated Instruction (DI) Based on Teachers' Experiences in Indonesia. *Education Sciences*, 12(10), 650. <https://doi.org/10.3390/educsci12100650>
- Johler, M., & Krumsvik, R. J. (2022). Increasing inclusion through differentiated instruction in a technology-rich primary school classroom in Norway. *Education* 3-13, 1–15. <https://doi.org/10.1080/03004279.2022.2143721>
- Kholid, B., Rahman, A., & Irawan, L. A. (2024). Implementing Diagnostic Assessment in Designing Differentiated Learning for English Language Learning at the Junior High Schools. *Journal of Language and Literature Studies*, 4(2), 445–458. <https://doi.org/10.36312/jolls.v4i2.1934>
- Kyeremeh, P., Adzifome, N. S., & Amoah, E. K. (2022). In-service mathematics teachers' knowledge of differentiated instruction. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, 7(2), 64–76. <https://doi.org/10.23917/jramathedu.v7i2.16863>
- Langelan, B. N., Gaikhorst, L., Smets, W., & Oostdam, R. J. (2024). Differentiating instruction: Understanding the key elements for successful teacher preparation and development. *Teaching and Teacher Education*, 140, 104464. <https://doi.org/10.1016/j.tate.2023.104464>
- Lerang, M. S., Ertesvåg, S. K., & Virtanen, T. (2021). Patterns of teachers' instructional support quality and the association with job satisfaction and collegial collaboration. *Educational Psychology*, 41(10), 1300–1318. <https://doi.org/10.1080/01443410.2021.1988519>
- Lindner, K.-T., & Schwab, S. (2020). Differentiation and individualization in inclusive education: A systematic review and narrative synthesis. *International Journal of Inclusive Education*, 1–21. <https://doi.org/10.1080/13603116.2020.1813450>
- Moya, N., & Tobar, M. (2019). Differentiated Instruction: Productive Skills Development with High School And University Students. *Investigación y Desarrollo*, 11, 67. <https://doi.org/10.29033/id.v11i1.645>
- Ojong, A. S. (2023). Unraveling the Efficacy of Differentiated Instruction in Enhancing Second Language Acquisition: A Comprehensive Review and Future Directions. *International Journal of Linguistics, Literature and Translation*, 6(6), 75–82. <https://doi.org/10.32996/ijllt.2023.6.6.8>
- Onyishi, C. N., & Sefotho, M. M. (2020). Teachers' perspectives on the use of differentiated instruction in inclusive classrooms: Implication for teacher education. *International Journal of Higher Education*, 9(6), 136–150. <https://doi.org/10.5430/ijhe.v9n6p136>
- Oskarsson, A., & Johansson, A. (1987). Lead-induced inclusion bodies in rat kidney after perinatal treatment with lead and disulfiram. *Toxicology*, 44(1), 61–72. [https://doi.org/10.1016/0300-483X\(87\)90046-1](https://doi.org/10.1016/0300-483X(87)90046-1)
- Partami, I. (2019). Differentiated Instruction In Multicultural Classroom Of Primary Years Programme In Gandhi Memorial Intercontinental School–Bali. *Jurnal Pendidikan Bahasa Inggris Indonesia*, 7(1), 1–11. <https://doi.org/10.23887/jpbi.v7i1.2717>
- Putra, G. S. (2023). Misconception tendency of differentiated instruction in publicly shared teaching and learning videos on YouTube: A mixed-methods exploration study. *Jurnal Penelitian Dan Evaluasi Pendidikan*, 27(2), 189–200. <https://doi.org/10.21831/pep.v27i2.60233>
- Sapan, M., & Mede, E. (2022). The Effects of Differentiated Instruction (DI) on Achievement, Motivation, and Autonomy among English Learners. *Iranian Journal of Language Teaching Research*, 10(1), 127–144. <https://doi.org/10.30466/ijltr.2022.121125>
- Schildkamp, K., Van Der Kleij, F. M., Heitink, M. C., Kippers, W. B., & Veldkamp, B. P. (2020). Formative assessment: A systematic review of critical teacher prerequisites for classroom practice. *International Journal of Educational Research*, 103, 101602. <https://doi.org/10.1016/j.ijer.2020.101602>
- Smets, W., & Struyven, K. (2020). A teachers' professional development program to implement differentiated instruction in secondary education: How far do teachers reach? *Cogent Education*, 7(1), 1742273. <https://doi.org/10.1080/2331186X.2020.1742273>
- Suprayogi, M. N., Valcke, M., & Godwin, R. (2017). Teachers and their implementation of differentiated instruction in the classroom. *Teaching and Teacher Education*, 67, 291–301. <https://doi.org/10.1016/j.tate.2017.06.020>
- Suryati, I., Ratih, K., & Maryadi, M. (2023). Teachers' Challenges in Implementing Differentiated Instruction in Teaching English at Junior High School. *Eduvest - Journal of Universal Studies*, 3, 1693–1708. <https://doi.org/10.59188/eduvest.v3i9.871>
- Tupiño, R. M. L., Carcausto-Calla, W., Nakiche, K. C., Gamarra, S. K. S., & Shigetomi, E. E. G. (2023). Differentiated Methodological Strategies for Inclusive Education in Basic Education: Scoping Review. *Journal of Educational and Social Research*, 13(6), 56. <https://doi.org/10.36941/jesr-2023-0147>

- Umayrah, A., Iswara, P. D., Salsabila, S., Azzahra, S. S., & Jeujan, M. (2024). The Nature of Differentiated Learning in The Perspective of Constructivist Educational Philosophy: A Systematic Literature Review. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, 10(2), 691. <https://doi.org/10.33394/jk.v10i2.11474>
- Westbroek, H. B., van Rens, L., van den Berg, E., & Janssen, F. (2020). A practical approach to assessment for learning and differentiated instruction. *International Journal of Science Education*, 42(6), 955-976. <https://doi.org/10.1080/09500693.2020.1744044>
- Yuen, S. Y., Luo, Z., & Wan, S. W. yan. (2023). Challenges and Opportunities of Implementing Differentiated Instruction amid the COVID-19 Pandemic: Insights from a Qualitative Exploration. *Education Sciences*, 13(10). <https://doi.org/10.3390/educsci13100989>
- Zoraloğlu, S., & Şahin, A. E. (2022). Farklılaştırılmış Öğretim Yaklaşımına Yönelik Öğretmen Yeterlikleri. *Cukurova University Faculty of Education Journal*, 51(2), 1377-1416. <https://doi.org/10.14812/cuefd.1072058>