Jurnal Guru Dikmen dan Diksus
Volume 8 Number 1, 2025. Page 61-70
p-ISSN: 2655-481x, e-ISSN: 2723-6404

Assessment Differentiation Workshop as an Innovation to Strengthen Student Creativity and Critical Reasoning

Lydia Valensia
SMA Negeri 5 Palembang, Indonesia

Email: valensialydia@gmail.com

(Received: June 10, 2022; Accepted: October 25, 2022; Published: June 30, 2025)

ABSTRACT

This study examines students' creativity and critical reasoning during learning through ADIL (Assessment–Differentiation–Workshop), an instructional innovation integrating non-cognitive diagnostic assessment, differentiated learning, and a workshop-style exhibition of student products. The study used a qualitative descriptive best-practice design involving 32 Grade XII Science 1 students at SMA Negeri 5 Palembang. Data were obtained through non-cognitive diagnostic assessment, classroom observation, student worksheets, problem-posing activities, and evaluation of products displayed in the workshop. The findings show progressive movement in critical-reasoning performance across meetings. By the fourth observation, 75.00% of students were classified as proficient or highly proficient on Indicator 1 (questioning), while 71.88% reached those categories on Indicator 2 (identifying, clarifying, and processing information and ideas). Creativity was particularly evident during the final workshop: 81.25% of students were classified as highly proficient in generating original ideas and producing original works or actions. The findings indicate that ADIL provides a structured way to respond to learner diversity while creating opportunities for questioning, contextual problem posing, product creation, peer interaction, and public presentation. Because the study is descriptive and involves one class, the results should be interpreted as evidence of classroom improvement rather than causal effectiveness.

Keywords: assessment; creativity; critical reasoning; differentiated instruction; workshop

INTRODUCTION

Post-pandemic schooling has intensified attention to learning recovery, learner diversity, and the need to rebuild higher-order thinking. International evidence has documented substantial disruption to learning opportunities and achievement during COVID-19, with unequal effects across students and contexts (Engzell et al., 2021; Hammerstein et al., 2021; Patrinos et al., 2022; Betthäuser et al., 2023). In this context, classroom innovation needs to address not only content mastery but also students' capacity to question, evaluate information, generate ideas, and communicate products. Critical thinking and creativity are consistently positioned as central competencies for contemporary learning and future participation (Dwyer et al., 2014; van Laar et al., 2017; Lucas, 2019; OECD, 2019).

In Indonesia, these priorities align with the Pancasila Student Profile, particularly the dimensions of critical reasoning and creativity. The source classroom also presented heterogeneous interests, readiness, and learning profiles, while teacher observation suggested that students had many ideas but required stronger stimulation and more space to develop them. Differentiated instruction is relevant to such heterogeneity because it adjusts content, process, product, and learning support in response to learner readiness, interests, and profiles (Tomlinson, 2001; Tomlinson, 2014; Deunk et al., 2018; Smale-Jacobse et al., 2019). However, differentiation is most productive when it remains connected to clear learning goals, formative assessment, cognitively demanding tasks, and meaningful opportunities for student agency (Black & Wiliam, 2009; Hattie & Timperley, 2007; Panadero et al., 2018; Schildkamp et al., 2020).

The innovation examined here is ADIL, an acronym for Assessment–Differentiation–Workshop. It begins with non-cognitive diagnostic assessment, uses differentiated grouping and learning experiences, and culminates in a workshop or exhibition in which students publicly present products generated from contextual mathematical problem posing. The study asks how students' critical reasoning and creativity develop during this process and describes the distribution of performance across the indicators used in the original classroom practice.

LITERATURE REVIEW

Differentiated Instruction and Diagnostic Assessment

Differentiated instruction conceptualizes learner variability as a normal condition of classrooms rather than an exception. Research indicates that adaptive grouping, differentiated tasks, and responsive instructional decisions can support learning when teachers use evidence of student needs systematically (Deunk et al., 2018; Smale-Jacobse et al., 2019; Pozas et al., 2020; Bondie et al., 2019; Prast et al., 2018). Diagnostic and formative assessment provide the evidence base for these decisions by identifying starting points and enabling teachers to adjust instruction during learning (Black & Wiliam, 2009; Bennett, 2011; Wiliam, 2011; Andrade, 2019; Wisniewski et al., 2020; Heritage, 2010; Kingston & Nash, 2011). Feedback is particularly valuable when it clarifies goals, current performance, and actionable next steps (Hattie & Timperley, 2007; Lipnevich & Panadero, 2021).

Critical Reasoning, Creativity, and Mathematical Problem Posing

Critical reasoning involves purposeful interpretation, analysis, evaluation, inference, and justification. Classroom approaches that make thinking visible and require students to formulate questions, compare information, justify decisions, and reflect on reasoning can strengthen these capacities (Dwyer et al., 2014; Abrami et al., 2015; Huber & Kuncel, 2016; Tiruneh et al., 2017; Bezanilla et al., 2019). Creativity is similarly supported by environments that value originality, exploration, productive risk, and multiple

representations rather than single predetermined responses (Beghetto, 2019; Henriksen et al., 2016; Lucas, 2019; Cremin & Chappell, 2021; Kupers et al., 2019).

Problem posing is especially relevant in mathematics because students must transform situations into questions, examine relationships, and generate solvable structures. Such activity can reveal conceptual understanding while opening space for divergent thinking (Cai et al., 2015; Singer et al., 2013; Leikin, 2013; Silver, 1997; English, 2020). Collaborative dialogue and public presentation further provide opportunities to articulate and revise ideas through interaction (Mercer et al., 2019; Howe et al., 2019; Gillies, 2016; van Leeuwen & Janssen, 2019). Product exhibitions can also increase authenticity and audience awareness, characteristics associated with project-oriented and student-centered learning (Kokotsaki et al., 2016; Guo et al., 2020; Almulla, 2020; Markula & Aksela, 2022).

METHODS

Design and Participants

This study employed a qualitative descriptive best-practice design. The participants were 32 students of Grade XII Science 1 at SMA Negeri 5 Palembang. The objects of observation were student creativity and critical-reasoning ability. The learning sequence was implemented across six meetings. Because the original design did not include a control group, random assignment, or inferential testing, the analysis is descriptive and does not establish causal effects.

ADIL Procedure and Data Collection

The ADIL sequence comprised three integrated components. First, a non-cognitive diagnostic assessment mapped students' interests, learning profiles, and perceived learning needs. Second, differentiation was used to organize students and learning experiences according to the information obtained. Student worksheets guided discussion, and at the end of each worksheet students posed one contextual problem related to the topic and wrote a reflection. Third, students prepared products for a workshop-style exhibition attended by the principal, teachers, and students from other classes. Products included handwritten visual work, banners, and barcode-supported displays.

Data were collected through the diagnostic assessment, classroom observation, student worksheets, problem-posing tasks, and observation of products. Critical reasoning was evaluated through two indicators: (1) asking questions and (2) identifying, clarifying, and processing information and ideas. Creativity was evaluated through two indicators: generating original ideas and producing original works or actions. Performance categories followed the classroom rubric: beginning to develop, developing, proficient, and highly proficient.

Dimension	Indicator	Evidence
Critical reasoning	Asking questions	Questions used to identify, clarify, interpret, or critically analyze problems
Critical reasoning	Identifying, clarifying, and processing information/ideas	Selection, comparison, clarification, analysis, prioritization, and justification
Creativity	Generating original ideas	Originality and exploration in ideas
Creativity	Producing original works/actions	Student products and modes of presentation in the workshop

RESULTS AND DISCUSSION

Critical-Reasoning Development

At the second meeting, Indicator 1 included 5 students beginning to develop, 6 developing, 9 proficient, 9 highly proficient, and 3 absent. For Indicator 2, the corresponding counts were 4, 3, 10, 12, and 3. These distributions indicate that a substantial proportion of students were already in the proficient or highly proficient categories, while a smaller group still required scaffolding.

Indicator	Beginning	Developing	Proficient	Highly proficient	Absent
Asking questions	5	6	9	9	3
Processing information and ideas	4	3	10	12	3

Across subsequent observations, the number of students in the beginning category declined. For Indicator 1, it decreased from 10 students at the first observation to 1 student by the fourth; for Indicator 2, it declined from 8 to 3 students. By the fourth observation, the combined proficient and highly proficient categories reached 75.00% for Indicator 1 and 71.88% for Indicator 2. This pattern is consistent with research emphasizing repeated opportunities to question, justify, and revise reasoning rather than treating critical thinking as a one-off activity (Abrami et al., 2015; Tiruneh et al., 2017; Mercer et al., 2019). The differentiated structure may also have reduced participation barriers by allowing students to work with peers and modes of engagement more closely aligned with their learning profiles (Pozas et al., 2020; Smale-Jacobse et al., 2019).

Creativity and the Workshop

The sixth meeting culminated in a workshop exhibition. Students presented diverse products using handwritten paintings or displays, banners, and barcode-supported materials. Visitors asked questions and interacted directly with product creators, creating a two-way exchange of ideas. Based on the two creativity indicators, 81.25% of students were categorized as highly proficient, while the remaining students were

distributed across proficient, developing, and beginning categories. This result suggests that the workshop created an authentic audience for student work and expanded the learning task beyond worksheet completion.

Creativity category	Percentage
Highly proficient	81.25%
Proficient	9.38%
Developing	6.25%
Beginning to develop	3.12%

The strong concentration in the highly proficient category should be interpreted within the study design. It describes performance under the classroom rubric rather than a standardized creativity measure. Nevertheless, the observed diversity of products and public explanation is theoretically consistent with research showing that creativity benefits from autonomy, meaningful constraints, collaboration, and opportunities to externalize ideas in tangible forms (Henriksen et al., 2016; Beghetto, 2019; Cremin & Chappell, 2021; Guo et al., 2020). The problem-posing component likely contributed by requiring students to construct rather than merely answer mathematical questions (Cai et al., 2015; Singer et al., 2013; Leikin, 2013).

Instructional Implications

ADIL combines assessment for learning, responsive differentiation, contextual problem posing, and public product presentation. These elements are mutually reinforcing: diagnostic information supports instructional adaptation; differentiation supports access and participation; problem posing creates cognitive demand; and the workshop gives products a social purpose. This alignment is consistent with evidence that formative assessment is strongest when information is actually used to modify teaching and learning (Black & Wiliam, 2009; Schildkamp et al., 2020), and that student-centered project work is more effective when goals, scaffolding, collaboration, and assessment remain explicit (Kokotsaki et al., 2016; Guo et al., 2020; Almulla, 2020).

Limitations

The study involved one class of 32 students and used a descriptive best-practice design. It did not include a comparison group, pretest–posttest standardized measures, inter-rater reliability estimates, or inferential statistics. Attendance also varied across meetings. Accordingly, the findings should not be generalized as proof that ADIL caused the observed improvement. Future studies should use validated critical-thinking and creativity instruments, multiple raters, comparison conditions, and longitudinal follow-up while retaining the contextual strengths of the workshop model.

CONCLUSION AND RECOMMENDATIONS

The ADIL strategy provided a coherent classroom structure for responding to learner diversity while strengthening opportunities for critical reasoning and creativity. Across the observed meetings, students moved toward higher critical-reasoning categories; by the fourth observation, proficient and highly proficient performance reached 75.00% for questioning and 71.88% for identifying, clarifying, and processing information and ideas. During the final workshop, 81.25% of students were categorized as highly proficient in creativity. These findings support the practical value of integrating diagnostic assessment, differentiated learning, contextual problem posing, and a public workshop within one learning sequence. Schools may adapt ADIL to other subjects and contexts, but implementation should remain responsive to student needs and local conditions. Further research should test the model with stronger comparative designs and validated measures, including interdisciplinary projects connected to the Pancasila Student Profile.

REFERENCES

Abrami, P. C., Bernard, R. M., Borokhovski, E., Waddington, D. I., Wade, C. A., & Persson, T. (2015). Strategies for teaching students to think critically: A meta-analysis. Review of Educational Research, 85(2), 275–314.

Almulla, M. A. (2020). The effectiveness of the project-based learning approach as a way to engage students in learning. SAGE Open, 10(3), 1–15.

Andrade, H. L. (2019). A critical review of research on student self-assessment. Frontiers in Education, 4, 87.

Beghetto, R. A. (2019). Structured uncertainty: How creativity thrives under constraints and uncertainty. In Creativity Under Duress in Education? Springer.

Bennett, R. E. (2011). Formative assessment: A critical review. Assessment in Education: Principles, Policy & Practice, 18(1), 5–25.

Betthäuser, B. A., Bach-Mortensen, A. M., & Engzell, P. (2023). A systematic review and meta-analysis of the evidence on learning during the COVID-19 pandemic. Nature Human Behaviour, 7, 375–385.

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. Educational Assessment, Evaluation and Accountability, 21, 5–31.

Bondie, R. S., Dahnke, C., & Zusho, A. (2019). How does changing "one-size-fits-all" to differentiated instruction affect teaching? Review of Research in Education, 43(1), 336–362.

Cai, J., Hwang, S., Jiang, C., & Silber, S. (2015). Problem-posing research in mathematics education. In Mathematical Problem Posing. Springer.

Cremin, T., & Chappell, K. (2021). Creative pedagogies: A systematic review. Research Papers in Education, 36(3), 299–331.

Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis. Educational Research Review, 24, 31–54.

Dwyer, C. P., Hogan, M. J., & Stewart, I. (2014). An integrated critical thinking framework for the 21st century. Thinking Skills and Creativity, 12, 43–52.

Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning loss due to school closures during the COVID-19 pandemic. Proceedings of the National Academy of Sciences, 118(17), e2022376118.

English, L. D. (2020). Teaching and learning through mathematical problem posing. In Encyclopedia of Mathematics Education. Springer.

Gillies, R. M. (2016). Cooperative learning: Review of research and practice. Australian Journal of Teacher Education, 41(3), 39–54.

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education. International Journal of Educational Research, 102, 101586.

Hammerstein, S., König, C., Dreisörner, T., & Frey, A. (2021). Effects of COVID-19-related school closures on student achievement: A systematic review. Frontiers in Psychology, 12, 746289.

Hattie, J., & Timperley, H. (2007). The power of feedback. Review of Educational Research, 77(1), 81–112.

Henriksen, D., Mishra, P., & Fisser, P. (2016). Infusing creativity and technology in 21st century education. Educational Technology & Society, 19(3), 27–37.

Howe, C., Hennessy, S., Mercer, N., Vrikki, M., & Wheatley, L. (2019). Teacher–student dialogue during classroom teaching. Learning, Culture and Social Interaction, 20, 1–16.

Huber, C. R., & Kuncel, N. R. (2016). Does college teach critical thinking? A meta-analysis. Review of Educational Research, 86(2), 431–468.

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. Improving Schools, 19(3), 267–277.

Kupers, E., Lehmann-Wermser, A., McPherson, G., & van Geert, P. (2019). Children's creativity: A theoretical framework and systematic review. Review of Educational Research, 89(1), 93–124.

Leikin, R. (2013). Evaluating mathematical creativity. Creativity Research Journal, 25(4), 388–396.

Lipnevich, A. A., & Panadero, E. (2021). A review of feedback models and theories. Frontiers in Education, 6, 720195.

Lucas, B. (2019). Why we need to stop talking about twenty-first century skills. Centre for Strategic Education Seminar Series, 289, 1–18.

Markula, A., & Aksela, M. (2022). The key characteristics of project-based learning. LUMAT: International Journal on Math, Science and Technology Education, 10(1), 1–26.

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom. International Journal of Educational Research, 97, 187–199.

OECD. (2019). PISA 2018 Assessment and Analytical Framework. OECD Publishing.

Panadero, E., Andrade, H., & Brookhart, S. M. (2018). Fusing self-regulated learning and formative assessment. The Australian Educational Researcher, 45, 13–31.

Patrinos, H. A., Vegas, E., & Carter-Rau, R. (2022). An analysis of COVID-19 student learning loss. World Bank Policy Research Working Paper 10033.

Pozas, M., Letzel, V., & Schneider, C. (2020). Teachers and differentiated instruction: Exploring differentiation practices. Journal of Research in Special Educational Needs, 20(3), 217–230.

Prast, E. J., Van de Weijer-Bergsma, E., Kroesbergen, E. H., & Van Luit, J. E. H. (2018). Differentiated instruction in primary mathematics. Learning and Instruction, 54, 22–34.

Schildkamp, K., van der Kleij, F. M., Heitink, M. C., Kippers, W. B., & Veldkamp, B. P. (2020). Formative assessment: A systematic review. Educational Research Review, 30, 100329.

Silver, E. A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. ZDM, 29, 75–80.

Singer, F. M., Ellerton, N., & Cai, J. (2013). Problem-posing research in mathematics education. Educational Studies in Mathematics, 83, 1–7.

Smale-Jacobse, A. E., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated instruction in secondary education: A systematic review. Frontiers in Psychology, 10, 2366.

Tiruneh, D. T., De Cock, M., Weldeslassie, A. G., Elen, J., & Janssen, R. (2017). Measuring critical thinking in physics. International Journal of Science and Mathematics Education, 15, 663–682.

Tomlinson, C. A. (2001). How to Differentiate Instruction in Mixed-Ability Classrooms. ASCD.

Tomlinson, C. A. (2014). The Differentiated Classroom: Responding to the Needs of All Learners. ASCD.

van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. Computers in Human Behavior, 72, 577–588.

van Leeuwen, A., & Janssen, J. (2019). A systematic review of teacher guidance during collaborative learning. Educational Research Review, 27, 71–89.

Wiliam, D. (2011). What is assessment for learning? Studies in Educational Evaluation, 37(1), 3–14.

Wisniewski, B., Zierer, K., & Hattie, J. (2020). The power of feedback revisited: A meta-analysis. Frontiers in Psychology, 10, 3087.

Bezanilla, M. J., Fernández-Nogueira, D., Poblete, M., & Galindo-Domínguez, H. (2019). Methodologies for teaching-learning critical thinking in higher education. Thinking Skills and Creativity, 33, 100584.

Kettler, T., Lamb, K. N., Willerson, A., & Mullet, D. R. (2018). Teachers' perceptions of creativity in the classroom. Creativity Research Journal, 30(2), 164–171.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. Creativity Research Journal, 24(1), 92–96.

Sawyer, R. K. (2012). Explaining Creativity: The Science of Human Innovation. Oxford University Press.

Beghetto, R. A., & Kaufman, J. C. (2014). Classroom contexts for creativity. High Ability Studies, 25(1), 53–69.

Richardson, C., & Mishra, P. (2018). Learning environments that support student creativity. Thinking Skills and Creativity, 27, 45–54.

Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., & Howe, A. (2013). Creative learning environments in education: A systematic literature review. Thinking Skills and Creativity, 8, 80–91.

Heritage, M. (2010). Formative assessment and next-generation assessment systems. Educational Testing Service research report.

Kingston, N., & Nash, B. (2011). Formative assessment: A meta-analysis and a call for research. Educational Measurement: Issues and Practice, 30(4), 28–37.