Pedagogy and Psychology of Sport. 2026;29:68703. eISSN 2450-6605. https://doi.org/10.12775/PPS.2026.29.68703

Pedagogy and Psychology of Sport. elSSN 2450-6605
Journal Home Page
https://apcz.umk.pl/PPS/index

ULLAH, Sohaib, LIU, Xin and ZAIB, Marwa. Improving Science Learning in Grade 8 through Ipsative Assessment: Insights from Action Research. Pedagogy and Psychology of Sport. 2026;29:68703. eISSN 2450-6605.
https://doi.org/10.12775/PPS.2026.29.68703

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 30.01.2026. Revised: 05.02.2026. Accepted: 05.02.2026. Published: 25.02.2026.

Improving Science Learning in Grade 8 through Ipsative Assessment: Insights from Action Research

Sohaib Ullah[1†]
Email: Sohaibullah09@gmail.com
ORCID: https://orcid.org/0009-0004-6892-1858
Xin Liu[1†]
Email: xliu84896@gmail.com
ORCID: https://orcid.org/0009-0001-5556-9945
Marwa Zaib[2*]
Email: maro5jahangir@gmail.com

Affiliation: [1]Center for Studies of Education and Psychology of Ethnic Minorities in Southwest China of Southwest University, Chongqing, China
Affiliation: [2]Department of Education, University of Chitral, Pakistan

Corresponding* Marwa Zaib, Email: maro5jahangir@gmail.com
Department of Education, University of Chitral, Pakistan

Abstract

Introduction: This action research aimed to explore the use of ipsative assessment as a strategy to enhance students' science learning. Conducted at a private school in District Lower Chitral, Khyber Pakhtunkhwa, Pakistan, the study employed a qualitative action research design, focusing on teacher observation and reflective practice. The study involved 25 Grade 8 students, with science as a core subject. Ipsative assessment was used, where students compared their current performance with their previous achievements rather than with peers.

Objective: The main objective was to investigate the impact of ipsative assessment on students' learning outcomes, including their awareness of progress, engagement, motivation, and response to feedback.

Material and Method: Data were collected through classroom observations, teacher reflective journals, students' written work, and informal reflection discussions. The collected data were analyzed using thematic analysis to identify patterns related to students' learning progress and engagement.

Results: The results indicated that ipsative assessment significantly increased students' awareness of their personal learning achievements. It also fostered greater participation in science classes. Feedback focused on improvement was positively received by students, enhancing their confidence and motivation. Reflective teaching practices enabled the teacher to identify learning gaps and adjust instructional strategies accordingly.

Conclusions: The research concluded that ipsative assessment is an effective formative tool that supports student-centered learning and improves science learning outcomes. The findings suggest that implementing ipsative assessment can enhance teaching quality and create a more engaging and motivating learning environment for students.

Keywords: Ipsative Assessment, Formative Assessment, Science Learning, Student Engagement, Reflective Practice

1. Introduction

Evaluation is a key to the formulation of the learning process among students, especially in the primary level, where fundamental scientific ideas are acquired (1). Over the past few years, it has become increasingly acknowledged that some assessment practices, which tend to focus on

comparison between students and end results, are not sufficient to facilitate the ongoing learning process and personal progress (2). This issue is more acute in primary science education, in which young students need constant feedback, motivation, and the need to self-evaluate their learning process to acquire conceptual knowledge and be able to think scientifically (3, 4).

Another formative assessment model that has come up is ipsative assessment that is not based on comparing a learner to other learners but comparing a learner to his or her own performance in the past (5). Directly focusing on individual progress, ipsative assessment enhances self-reflection, motivation, and goal-oriented learning (6). This strategy is best applicable to the primary classrooms where students differ in pace, ability, and learning styles (7). Some studies indicate that students are more motivated to learn and become concerned about their academic outcomes when they receive feedback that shows that they are doing well, but there is room to improve (8, 9).

Constant monitoring of progress in science learning at the lower level is imperative since concepts are cumulative, and wrong ideas developed at an early age may linger when no effort is made to correct them (10). Ipsative assessment is a useful tool that allows teachers to monitor the learning patterns of students over a period of time and to adapt instruction to them (11). In the framework of classroom-based inquiry, action research provides a methodical approach that allows teachers to apply such assessment techniques and monitor their effects and assess their efficiency in enhancing teaching and learning processes (12, 13). Consequently, the action research problem is the application of ipsative assessment as a tool for enhancing the science learning of primary level students (14).

1.1. Research Questions:

1. What impact does ipsative assessment have on primary-level science learning among students?

2. How can ipsative assessment influence students' self-perception of their learning achievements in science?

1.2. Research Objectives:

1. To implement ipsative assessment strategies in primary science education.

2. To evaluate the long-term impact of ipsative assessment on students' science learning.

1.3. Significance of the Study

This study is significant as it explores the use of ipsative assessment in primary science education to promote learner-centered pedagogy. By focusing on individual progress rather than peer comparison, ipsative assessment can foster a more inclusive and motivational learning environment. The findings will provide teachers with insights into how to implement effective feedback mechanisms that enhance student engagement, confidence, and interest in science. Furthermore, the research offers valuable guidance for teachers and educational institutions on integrating formative assessment practices to improve instructional quality and student outcomes.

2. Literature Review

2.1. Assessment for Learning in Primary Education

Assessment for Learning (AfL) is gaining prominence for its role in integrating assessment into the teaching and learning process (15). Unlike traditional assessments, which focus on outcomes, AfL emphasizes using assessment to foster ongoing learning by providing feedback that guides students toward improvement. AfL is crucial in primary education, where foundational skills and learning habits are developing (16). Effective feedback helps students understand their progress, reduces anxiety, and encourages growth. However, challenges remain in applying AfL effectively in primary classrooms due to curriculum demands and traditional assessment cultures (17). Ipsative assessment, which focuses on personal progress, aligns well with AfL and may offer a practical solution to enhance learning (18).

2.2. Limitations of Traditional Assessment Practices in Primary Science Education

Traditional assessment practices, especially in primary science education, primarily focus on summative assessments like tests and grades, which limit feedback on individual progress. These methods can demotivate students, especially those struggling academically, and fail to assess deeper understanding (19). They also hinder self-regulation and reflection, essential for conceptual learning in science. The emphasis on competition and memorization in traditional assessments is counterproductive in fostering a deeper, inquiry-based understanding of science (9, 20). Thus, alternative assessment methods like ipsative assessment, which focus on individual progress, could be more effective in promoting student growth and engagement.

2.3. Concept and Characteristics of Ipsative Assessment

Ipsative assessment measures a learner's progress by comparing their current performance to their past achievements. This approach emphasizes individual growth, helping students recognize improvements over time, which boosts motivation and self-confidence. Unlike traditional assessments, ipsative assessment is formative and integrated into classroom practices, providing timely, actionable feedback (21, 22). This method fosters metacognitive skills and encourages reflection, which is particularly beneficial for primary students. Despite challenges in large-scale accountability, ipsative assessment is highly effective in primary science education, where gradual, concept-driven learning is essential (23, 24).

2.4. Ipsative Assessment and Student Motivation

Ipsative assessment can significantly enhance student motivation by focusing on personal improvement rather than peer comparison. It helps students develop a growth mindset by making progress visible, which reduces anxiety and encourages active engagement in learning (25, 26). Research indicates that when students track their own progress, they develop greater self-efficacy and a stronger belief in their ability to succeed. In primary science, where concepts are often abstract and challenging, ipsative assessment fosters confidence and promotes sustained engagement in inquiry-based learning (20).

2.5. Role of Feedback and Self-Reflection in Ipsative Assessment

Feedback and self-reflection are central to ipsative assessment. Descriptive feedback, focused on improvement rather than grades, helps students understand their progress and areas for growth (11). Self-reflection encourages students to assess their own learning and set personal goals, fostering self-regulation and metacognitive awareness (27). In primary science education, this approach allows students to track their understanding of scientific concepts over time, enabling them to make necessary adjustments to their learning strategies (28). For ipsative assessment to be effective, feedback must be clear, specific, and linked to learning goals.

2.6. Improving Primary Science Learning through Classroom-Based Action Research

Action research offers a practical approach to improving science education by allowing teachers to reflect on their practices and make adjustments based on real-time classroom data. Combining formative assessment strategies like ipsative assessment with action research enables teachers to monitor student progress, adjust instructional methods, and foster inquiry-based learning (29, 30). This approach supports continuous improvement in science instruction and offers a structured way for teachers to implement and evaluate new assessment methods. The reflective nature of action research ensures that assessment practices evolve based on student needs and learning outcomes, providing a strong foundation for enhancing primary science education (12).

3. Methodology

3.1 Research Design

The research design used by the current study was a qualitative action research design to explore the effectiveness of ipsative assessment in enhancing science learning among the students (31). Action research was viewed as an adequate approach as it allows teachers to think through classroom practice systematically and consciously implement changes aimed at improving the learning process. The researchers used a cyclical planning, action, observation, and reflection process that gave the researcher the opportunity to constantly assess the efficacy of ipsative assessment in the instruction. The study adopted a qualitative approach since it was concerned with the learning process of students, their engagement, and their reaction to the feedback and not their overall achievement in terms of numerical values. The focus was on classroom observation and reflection teaching in a natural learning setting.

3.2 Research Setting

The study was done in a single private school in District Lower Chitral, Khyber Pakhtunkhwa, Pakistan. Lower Chitral is a mountainous area where schools tend to be poorly equipped in terms of instructional facilities; therefore, classroom-based assessment practices are of special importance. The chosen school had a formal curriculum, and science was a mandatory subject taught at the middle school level.

3.3 Participants of the Study

The sample of the study was 25 students, who took Science as one of the core subjects in Grade 8. The course was comprised of students with different academic abilities and learning rates.

The same material was delivered to all students, but the feedback on the assessment was done individually using ipsative assessment practices. The researcher was the teacher and played a dual role of an instructor and an observer. This position allowed communicating with students on a regular basis and tracking the learning behavior and engagement changes systematically.

3.4 Intervention: Ipsative Assessment Practices.

The intervention comprised the planned application of ipsative assessment in science lessons. The performance of the students was compared with their previous work, as opposed to that of their peers. The point of evaluation was on personal growth in knowledge, engagement, and accomplishment of tasks in the long run.

Ipsative assessment was adopted by: Comparison of prior and subsequent class work of students, the individual verbal and written feedback emphasize progress, Reflective classroom discussions, Progress notes are maintained by the teachers for each student, The intervention was highly organized in regular teaching, and this ensured a sense of continuity and authenticity.

3.5 Data Collection Tools

Since the study was of a qualitative nature, teacher observation was the major tool of collection of data. Students were observed in terms of their engagement, participation, feedback response, and observable learning progress.

The supporting tools were also the following: Journal reflective of the teacher to write down the observations and thoughts daily, Examples of writing work that students can use to record progress in learning, and students' unstructured comments obtained during classroom discussions. These instruments presented descriptive information that was very descriptive of the effect of ipsative assessment.

3.6 Data Collection Procedure

The data was gathered in the process of normal science lessons in the course of the study. The researcher monitored the students during classroom work, group work, and individual work. Systematic observations took place at the end of every lesson, and the focus was on the change in the understanding, confidence, and participation of the students. Periodically, samples of the students ' work were checked to determine the improvement patterns. Reflection notes were kept to record the emerging information about the progress of learning and the effectiveness of the assessment.

3.7 Data Analysis

The thematic qualitative analysis was used to analyze data (32). The observation, reflective journal entries, and work samples of students were checked several times to determine repetitive patterns and themes concerning improvement of learning, engagement, and motivation. Coding,

categorization, and interpretation of data were done to form meaningful themes in which the learning experience of students was observed over time.

3.8 Ethical Considerations

Ethics were given high regard during the study. The school administration was contacted and allowed to conduct the research. The identity of students was not disclosed, and all data was not utilized for any purpose other than academic. The activities of the research did not disrupt regular teaching and learning, and no harm was done to research participants.

4. Results

The thematic analysis of the data collected from classroom observations, reflective journals, student-written work, and informal conversations revealed several significant outcomes following the introduction of ipsative assessment in the primary science classroom. The key findings include:

4.1. Increased Student Awareness of Personal Learning Progress:

One of the most prominent results was the heightened awareness among students regarding their learning progress. Through regular feedback, students were able to compare their current understanding with their previous performance. This process allowed students to recognize improvements in their ability to explain scientific concepts and complete assignments. Notably, students became more comfortable acknowledging past mistakes and expressing how they had learned and improved over time. This shift towards focusing on personal growth, rather than solely on achieving competencies, significantly boosted their self-confidence and engagement in the learning process.

4.2. Enhanced Engagement and Participation:

Another key theme identified was the increased engagement and active participation of students in science lessons. Classroom observations indicated that students became more willing to engage in discussions, ask questions, and participate in practical activities without the fear of failure. This behavior change was attributed to the feedback emphasizing effort and progress rather than solely evaluating performance. The atmosphere in the classroom became more inclusive, with previously reluctant students becoming more involved, particularly in group discussions and practical tasks. The use of ipsative assessment appeared to reduce the

competitive nature of traditional assessments, fostering a more collaborative and supportive learning environment.

4.3. Positive Response to Feedback and Reflection:

The students' response to feedback was overwhelmingly positive, particularly when the feedback was focused on personal development and areas for improvement. It was observed that students were more attentive to the feedback provided and made efforts to apply suggestions in subsequent tasks. The reflective discussions, which were an integral part of the ipsative assessment process, also played a crucial role. Students were able to articulate what they had learned and how they had improved over time, thereby internalizing feedback and using it constructively to enhance their future learning. This process of reflection and feedback allowed students to move beyond superficial task completion and engage in more meaningful learning.

4.4. Increased Confidence and Motivation to Learn:

The study found that the use of ipsative assessment contributed significantly to the development of student confidence and motivation. By acknowledging and celebrating self-improvement, students became more willing to tackle challenging questions and engage with difficult concepts. Teachers noted that students were more enthusiastic about learning and showed greater persistence, even when they faced difficult tasks. The recognition of progress, even if mastery was not yet achieved, played a crucial role in maintaining student motivation. The students appeared to develop a more positive attitude towards science, which was particularly evident in students who had previously shown less interest or engagement in the subject.

4.5. Teacher Reflection and Instructional Adjustment:

From a teacher's perspective, ipsative assessment provided valuable insights into students' learning patterns. The reflective journal entries indicated that continuous monitoring of student progress enabled the teacher to identify learning gaps and misconceptions more efficiently. This allowed for timely adjustments to the instructional strategies, such as revisiting specific concepts or altering teaching methods to better meet the students' learning needs. The action research process also facilitated a shift towards reflective teaching, where assessment data was used not only to gauge outcomes but also to inform instructional decisions. This ongoing cycle

of observation, feedback, and adjustment contributed to an improved learning experience for students.

Overall, the findings suggest that ipsative assessment positively impacted both student engagement and learning in science. The method's emphasis on personal growth and continuous feedback fostered a more inclusive, supportive, and motivational learning environment. The teacher's ability to reflect on and adjust instructional practices further enhanced the effectiveness of the assessment strategy. These results highlight the potential of ipsative assessment as a valuable formative tool in primary science education.

5. Discussion

The findings from this study underscore the significant impact of ipsative assessment on primary students' engagement, motivation, and learning in science. By focusing on personal progress rather than peer comparison, ipsative assessment allowed students to become more aware of their individual learning journey. This shift in focus contributed to students developing a greater understanding of their strengths and weaknesses, which is essential for fostering a growth mindset (33). The increased student awareness of their learning progress aligns with the key benefits of formative assessment, as emphasized by (34), where ongoing feedback enables students to engage in self-reflection and set meaningful goals. This not only boosts self-confidence but also encourages students to approach learning as a continuous, evolving process rather than a static achievement. The positive changes observed in student confidence and engagement suggest that ipsative assessment can be a powerful tool in motivating students to take ownership of their learning.

Furthermore, the data demonstrated that ipsative assessment had a direct influence on student participation and classroom dynamics. The reduction in fear of failure, as indicated by the increased willingness of students to engage in discussions, ask questions, and participate in practical tasks, speaks to the importance of creating a safe and supportive learning environment (35). Traditional assessment methods, which focus on high-stakes testing and comparison, can often induce anxiety and discourage active participation, particularly among struggling students (36). In contrast, ipsative assessment emphasized effort and personal growth, leading to a more inclusive and participatory classroom atmosphere. This approach aligns with the work of (37), who highlighted that formative assessment methods such as questioning, observation, and feedback are critical in diagnosing student thinking and guiding instructional decisions. The

results of this study reinforce the notion that reducing the competitive nature of assessments can foster a more collaborative and engaging learning environment.

Finally, the role of feedback and self-reflection in ipsative assessment proved to be crucial in enhancing students' understanding and motivation. The reflective discussions and the personalized feedback students received helped them internalize their progress and apply it constructively in subsequent tasks (38). This process not only facilitated deeper learning but also promoted metacognitive development, as students became more aware of their learning strategies and areas for improvement. The findings support (39) assertion that formative feedback must be specific, timely, and actionable to be effective. In the context of ipsative assessment, the feedback focused on improvement rather than judgment, helping students view learning as a process of continuous growth (25). This is particularly important in primary science education, where conceptual understanding is often complex and requires ongoing reinforcement. The teacher's ability to make instructional adjustments based on feedback further enhances the effectiveness of this approach, allowing for a more responsive and adaptive teaching practice.

6. Conclusions

The current action research project addressed the application of ipsative assessment as one of the strategies to enhance science learning among students in a Grade 8 classroom setting. The results of the research show that ipsative assessment positively affected the engagement and motivation of students as well as their awareness of the progress of learning. Assessment was a learning tool instead of a judgmental one by comparing the present performance of students to their past performance.

The research proved that ipsative assessment is especially effective to support the practice of formative assessment in science education. Feedback that focused on the improvement and effort was positively received by students that added to the formation of confidence and desire to engage in learning activities. The self-reflective approach helped students to be more responsible towards their learning and embrace a growth perspective in their approach to learning scientific concepts. The action research process helped the teacher to be reflective in teaching as well as make informed decisions about teaching. The frequent monitoring and evaluation of the progress of students enabled the on-time modification of the teaching methods, which could have helped learners to fill learning gaps at a higher level. In general, the research finds that ipsative assessment is an effective and useful assessment method that can improve

science learning at the middle school level when used in reflective and student-centered practices.

Recommendations

Based on the findings of this study, it is recommended that teachers integrate ipsative assessment into regular classroom practices to focus on individual learning progress, using feedback that emphasizes improvement over grades or scores. Supporting self-awareness and self-regulation through reflection practices like learning journals and progress discussions will also be beneficial. Assessment should be observation-based to identify misconceptions early and adjust teaching methods accordingly. Schools should promote formative, learner-centered assessments, particularly at the primary and middle school levels, and include training on ipsative assessment and action research in professional development programs. Finally, future research should investigate the long-term effects of ipsative assessment on academic performance using mixed methods or longitudinal designs.

Author's Contribution

S.U contributed to the conceptualization, methodology, investigation, data curation, and writing – rough preparation. X.L was responsible for formal analysis, software, and visualization. M.Z contributed to the writing, review and editing, supervision, and project administration. All authors have read and agreed with the published version of the manuscript.

Funding Statement

The study did not receive specific funding.

Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Southwest University (protocol JPMA.5358 and 2026/01/10).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the reported results can be made available upon request from the Corresponding Author.

Acknowledgments

We would like to acknowledge the support of Dr. Qinyi Tan for their administrative and technical assistance.

Conflict of Interest Statement

The authors declare no conflict of interest.

References

1. Osiesi MP. Educational evaluation: functions, essence and applications in primary schools' teaching and learning. Society & Sustainability. 2020;2(2):1-9.
2. Clark I. Formative assessment: Assessment is for self-regulated learning. Educational psychology review. 2012;24(2):205-49.
3. Zimmerman BJ. From cognitive modeling to self-regulation: A social cognitive career path. Educational psychologist. 2013;48(3):135-47.
4. Ullah S, Ullah A, Manirahari P. Understanding the Role of Madrassas in Pakistan's Educational Landscape: A Data-Driven Perspective from Google Trends. Pedagogy and Psychology of Sport. 2025;26:66269-.
5. Ismail SM, Rahul D, Patra I, Rezvani E. Formative vs. summative assessment: impacts on academic motivation, attitude toward learning, test anxiety, and self-regulation skill. Language Testing in Asia. 2022;12(1):40.
6. Wu X-Y, Ng DTK, Chiu TK. Self-regulated learning with AI: A comparative analysis of General-Purpose and Task-Specific platforms. International Journal of Technology in Education. 2026;9(1):279-302.

7. Sharma GS. Assessment For Learning: AGPH Books| AG Publishing House; 2025.
8. Hanrahan M. The effect of learning environment factors on students' motivation and learning. International journal of science education. 1998;20(6):737-53.
9. Ullah S, Ullah A, Zaib M. Assessing the Demand for Skill-based Education in Pakistan: Insights from Google Trends Data. Pedagogy and Psychology of Sport. 2025;27:66462-.
10. Corcoran TB, Mosher FA, Rogat A. Learning progressions in science: An evidence-based approach to reform. 2009.
11. Crosby R. Using ipsative assessment to improve feedback quality and the student assessment experience in university computer science: Newcastle University; 2021.
12. Siregar T. Classroom action research-based learning innovations: Kemmis and McTaggart models. 2025.
13. Ullah S, Sikandar HM, Jihad A, Maaz M. AI in education, ChatGPT, and personalized learning: Measuring public attention in Pakistan through Google Trends. Culture, Education, and Future. 2025;3(3):391-404.
14. Nishizuka K. Significance and challenges of formative ipsative assessment in inquiry learning: a case study of writing activities in a "contemporary society" course in a Japanese high school. Sage Open. 2022;12(2):21582440221094599.
15. Lee I. Assessment for learning: Integrating assessment, teaching, and learning in the ESL/EFL writing classroom. Canadian modern language review. 2007;64(1):199-213.
16. Schellekens LH, Bok HG, De Jong LH, Van der Schaaf MF, Kremer WD, Van der Vleuten CP. A scoping review on the notions of Assessment as Learning (AaL), Assessment for Learning (AfL), and Assessment of Learning (AoL). Studies in Educational Evaluation. 2021;71:101094.
17. Mulyana T, Kurniasih S, Ardianto D. Assessment for learning: changes in the role of assessment in learning. IJORER: International Journal of Recent Educational Research. 2021;2(5):580-9.
18. Kumar B. Assessment for learning: a critical review of techniques and outcomes. Innovative Approaches to Multidisciplinary Exploration. 2025:33.
19. Alt D. Teachers' practices in science learning environments and their use of formative and summative assessment tasks. Learning Environments Research. 2018;21(3):387-406.
20. Kotsis KT. Integrating inquiry-based learning in the new Greek primary science curriculum. European Journal of Education and Pedagogy. 2024;5(6):63-71.

21. Haynes NM, Boudreaux MK, Gordon EW. A theory-informed and student-centered framework for comprehensive educational assessment. Handbook for Assessment in the Service of Learning. 2025;2.
22. Meškauskienė A, Guoba A. The impact of Assessment and Selfassessment methods of Learning achievements and Progress on adolescent self-esteem building. Pedagogika. 2016;124(4):160-71.
23. Nobutoshi M. Metacognition and reflective teaching: a Synergistic Approach to fostering critical thinking skills. Research and Advances in Education. 2023;2(9):1-14.
24. Fathi S. Opportunities and challenges of a concept-based approach in online education: a case study in secondary international education. 2024.
25. Hughes G. Towards a personal best: A case for introducing ipsative assessment in higher education. Studies in Higher Education. 2011;36(3):353-67.
26. Namaziandost E, Behbahani HK, Naserpour A. Peer support in language learning: Mitigating anxiety, enhancing achievement, cultivating growth mindsets, and increasing enjoyment. Journal of Applied Learning and Teaching. 2024;7(2):296-313.
27. Ratnayake A, Bansal A, Wong N, Saseetharan T, Prompiengchai S, Jenne A, et al. All "wrapped" up in reflection: supporting metacognitive awareness to promote students' self-regulated learning. Journal of Microbiology and Biology Education. 2024;25(1):e00103-23.
28. Krajcik JS, Czerniak CM. Teaching science in elementary and middle school: A project-based learning approach: Routledge; 2018.
29. Capobianco BM, Feldman A. Promoting quality for teacher action research: Lessons learned from science teachers' action research. Educational Action Research. 2006;14(4):497-512.
30. Correia CF, Harrison C. Teachers' beliefs about inquiry-based learning and its impact on formative assessment practice. Research in Science & Technological Education. 2020;38(3):355-76.
31. Kukol A. Combination of Ipsative and Sociomaterial Assessment Methodologies within University-Level Science Education. Higher Education for the Future. 2024;11(2):220-34.
32. Majumdar A. Thematic analysis in qualitative research. Qualitative techniques for workplace data analysis: IGI Global Scientific Publishing; 2019. p. 197-220.

33. Limeri LB, Carter NT, Choe J, Harper HG, Martin HR, Benton A, et al. Growing a growth mindset: Characterizing how and why undergraduate students' mindsets change. International Journal of STEM Education. 2020;7(1):35.
34. Black P, Wiliam D. Developing the theory of formative assessment. Educational Assessment, Evaluation and Accountability (formerly: Journal of personnel evaluation in education). 2009;21(1):5-31.
35. Abdullah MY, Bakar NRA, Mahbob MH. Student's participation in classroom: What motivates them to speak up? Procedia-Social and Behavioral Sciences. 2012;51:516-22.
36. Patterson K. A Qualitative Study About How Teacher Actions Increase Student Anxiety During High-stakes Testing: Northcentral University; 2019.
37. Wiliam D. What is assessment for learning? Studies in educational evaluation. 2011;37(1):3-14.
38. Narciss S, Sosnovsky S, Schnaubert L, Andrès E, Eichelmann A, Goguadze G, et al. Exploring feedback and student characteristics relevant for personalizing feedback strategies. Computers & Education. 2014;71:56-76.
39. Sadler DR. Fidelity as a precondition for integrity in grading academic achievement. Assessment & Evaluation in Higher Education. 2010;35(6):727-43.