Inovasi Kurikulum *- p-ISSN 1829-6750 & e-ISSN 2798-1363*
Volume 21 No 3 (2024) 1663-1682

Inovasi Kurikulum
https://ejournal.upi.edu/index.php/JIK

Designing mathematical modeling process worksheets for unifying assessment, instruction, and learning

Bambang Riyanto
SMKN 1 Sungai Menang/Dinas Pendidikan, Sumatera Selatan, Indonesia
risetmodelingbambang@gmail.com

ABSTRACT

The importance of unifying assessment is because current assessment practices are cumulative products of learning theories and measurement models developed to meet social and educational needs at different times. The research aims to produce a valid mathematical model for unifying assessment, instruction, and learning. The research approach is development research, which consists of 3 steps: analysis, design, and evaluation. The analysis step applies student analysis, curriculum, mathematical modeling, and real-world problems. The second step is design and product. In the final step, researchers used a formative evaluation design consisting of self-evaluation, one-to-one, expert review, small group, and field tests. Data were analyzed using descriptive analysis methods: (1) walk-through, analysis based on expert opinions to obtain a valid mathematical modeling process to unify assessment, instruction, and learning; (2) Results Analysis of the one-to-one. Expert validation of mathematical modeling processes in process worksheets can unify assessment, instruction, and learning. One-to-one results are exciting, challenging, and novel. A mathematical modeling process device was obtained as a valid process worksheet for unifying assessment, instruction, and learning. It is necessary to research other subjects using volatility, uncertainty, complexity, and ambiguity in real-world contexts.

ARTICLE INFO

Article History:
Received: 9 May 2024
Revised: 2 Aug 2024
Accepted: 4 Aug 2024
Available online: 19 Aug 2024
Publish: 30 Aug 2024

Keyword:
assessment; designing; instruction; learning; mathematical modeling; process worksheet

Open access
Inovasi Kurikulum is a peer-reviewed open-access journal.

ABSTRAK

Pentingnya penyatuan asesmen, karena praktik asesmen yang ada saat ini merupakan produk kumulatif dari teori belajar dan model pengukuran yang dikembangkan untuk memenuhi kebutuhan sosial dan pendidikan pada waktu yang berbeda. Tujuan penelitian adalah menghasilkan instruksi pemodelan matematika yang valid untuk penyatuan penilaian, instruksi dan pembelajaran. Pendekatan riset adalah Development research yang terdiri dari 3 langkah yaitu analisis, desain dan evaluasi. Pada langkah analisis diterapkan analisis siswa, kurikulum, pemodelan matematika dan permasalahan dunia nyata. Langkah kedua, desain dan produk. Pada langkah terakhir, peneliti menggunakan desain evaluasi formatif yang terdiri dari evaluasi diri, one-to-one, expert review, small group, dan field test. Data dianalisis dengan menggunakan metode analisis deskriptif: (1) walk through, analisis berdasarkan komentar para ahli untuk memperoleh instruksi pemodelan matematika yang valid untuk menyatukan penilaian, instruksi dan pembelajaran; (2) Menganalisis hasil one-to-one review. Validasi ahli instruksi pemodelan matematika dalam bentuk lembar kerja proses dapat menyatukan penilaian, instruksi dan pembelajaran. Hasil one-to-one masalah pemodelan ini menarik dan menantang serta baru. Diperoleh perangkat instruksi pemodelan matematika berupa lembar kerja proses yang valid untuk penyatuan penilaian, instruksi dan pembelajaran. Perlu dilakukan penelitian pada mata pelajaran lain dengan menggunakan konteks dunia nyata yang volatilitas, ketidakpastian, kompleksitas dan ambiguitas.

Kata Kunci: *asesmen; instruksi; lembar kerja proses; pembelajaran; pemodelan matematika; pendesainan*

How to cite (APA 7)
Riyanto, B. (2024). Designing mathematical modeling process worksheets for unifying assessment, instruction, and learning. *Inovasi Kurikulum, 21*(3), 1649-1682.

Peer review
This article has been peer-reviewed through the journal's standard double-blind peer review, where both the reviewers and authors are anonymised during review.

https://doi.org/10.17509/jik.v21i3.72173

INTRODUCTION

The current education system, which focuses on the predictable and known, has difficulty integrating creativity, a process that looks directly at the unknown with a focus on the new. This statement implies the importance of assessment in the education system. Overcoming existing challenges and taking advantage of available opportunities, performance assessments in the Kurikulum Merdeka and the Kurikulum 2013 can help students achieve their maximum potential and be ready to face future challenges with more confidence and competence (Deva et al., 2024). This shows that assessment can improve the quality of education and learning. For example, to learn something meaningfully, we must be able to connect our personal background knowledge with new information. This happens if we "cram" facts or information that are meaningless to us just for a test. Some research has developed a form of assessment to assist teachers in assessing learning and determining students' level of mastery comprehensively according to the mathematical skills taught in standard content and learning standards in the educational context (Nasir et al., 2024). This suggests there is too little research on integrating assessment, instruction, and learning in educational assessment.

The long-term process of student identity formation is rarely discussed in assessment research (Nieminen & Yang, 2023). This shows the importance of integrating assessment, instruction, and learning. Much evidence shows that current assessment practices are weak and even broken in many ways. Therefore, an essential prerequisite for creating a constructivist assessment process is that the course is constructively aligned. Teachers can better understand students' learning needs through formative assessment and adapt instruction. Formative assessment has gained recognition as a powerful tool for increasing learning effectiveness due to its role in informing teaching and scaffolding student learning (Wylie, 2020). Implementing formative assessments still requires support (Lam, 2019; Yan & Brown, 2021).

Many studies have reported that effective implementation of formative assessment is rarely seen in actual classroom practice in both Western and Eastern contexts (Yan & Brown, 2021). This shows that formative assessment is rare and only applied mechanistically and superficially. Even integrating assessment, instruction, and learning is far from expectations. Since “education and training” are some of the most critical factors influencing teachers' intentions and practices regarding formative assessment, teachers' lack of understanding and skills likely hinder the implementation of formative assessment (Yan et al., 2021). Teachers find it difficult to meet the diverse needs of students, and they lack pedagogical skills in implementing differentiated assessments. Thus, some teachers still use a uniform assessment strategy (Ihalon, 2022). Because of these deficiencies, students often face problems that require memorization rather than long-term demonstrations of creativity and understanding (Dunlop, 2018).

Developing teachers' formative assessment literacy is one possible way to address the worldwide challenge of teachers' lack of skills in formative assessment (Yan & Pastore, 2022). Controlling the quality of assessments is not an easy task and can be challenging, but it can be done through various approaches. The education system in Hong Kong is known for its exam-oriented culture, in which summative assessment plays a dominant role (Li et al., 2023). Including in Indonesia. Moreover, teachers generally listen to the “right” answer rather than what they can learn about students' thinking; in other words, they listen evaluatively rather than interpretively. Formative assessment is gradually becoming more widely recognized as supporting student learning (Guo & Yan, 2019). The importance of unifying assessment is because current assessment practices are the cumulative product of learning theories and measurement models developed to meet social and educational needs at different times. Also, traditional assessment methods typically fail to measure the high-level skills, knowledge, attributes, and characteristics of self-direction and collaborative learning that are increasingly important for the global economy and rapidly

https://doi.org/10.17509/jik.v21i3.72173

changing world. Exams should be reduced. Because of the over-reliance on summative assessment approaches, new ways of thinking about assessment make it impossible for teachers to adapt teaching and learning to meet students' individual needs. Recently, the idea of assessment as learning has received scholarly attention to address concerns about the mechanistic nature and overly literal application of formative assessment. In Indonesia, summative assessments should also be reduced to "checking".

Teaching and assessment have become separated, leaving teachers unable to develop the assessment skills they need to improve learning truly. Assessment should not be a separate part of learning. Assessment is critical, but there is a downside: it becomes holistic, and there is a risk that it may take priority over the learning that should be associated with it (Hammond et al., 2020). This statement shows the importance of unifying assessment and learning. High-quality teaching requires well-prepared assessments (Kasmi & Anasse, 2023). Assessment measures student progress and the effectiveness of the teaching process (Black & Wiliam, 2018). Assessment is a senior partner in learning and teaching. If you make an assessment error, then everything else collapses. The reason for the focus on assessment and improving assessment is its significant impact on the quality of student learning. We have not trusted teachers to collect and present evidence of their students' learning for decades for accountability. This shows that teachers use formative assessment data in everyday classes, not summatively. This has resulted in a school culture that separates those who test from those who teach, and the two will never meet, each with mutually exclusive competencies. This indicates the need to integrate assessment/learning to improve learning outcomes.

Assessors who conduct testing develop the competencies needed to carry out the testing work, while teachers who teach develop instructional competencies. This statement is crucial to change and improve the quality of learning outcomes in the 21st century. We must provide a deeper and more complete understanding of the basic principles of good assessment practice to parties outside schools who drive policy, resource allocation, and class priorities. On a large scale, this approach will change assessment practice, namely that the number of embedded micro-assessments over a year are interconnected so that each formative assessment builds on and links one another to enable “cumulative validity” which means that, by regularly assessing learning from over time, at the end of the year, a cumulative overall formative assessment allows for a summative understanding of student progress toward civics education learning goals. The importance of active learning strategies in extensive data analysis in education is empowering students through practical, interactive learning experiences. Educators can foster a generation of adept learners at harnessing the power of data (Tsai, 2024). So, it is very crucial to use a radical new approach that reverses the flow (psychometric experts typically start by selecting specific competencies to measure, then content experts conduct an extensive literature review to sort competencies based on their sub-constructs and related behaviors), i.e., rather than creating activities to measure competency sub-constructs, to start with an extant set of in-depth activities and analyze what behaviors are displayed, collecting this information in an extensive database.

Firstly, data-based curricula need to be redeveloped by considering learning objectives. Secondly, well-designed learning activities for extensive data curricula are recommended in the future. Three main theories are the basis for developing Big Data: behaviorism, cognitivism, and constructivism (Baig et al., 2023). Generating new knowledge and revealing gaps in knowledge through peer instruction effectively supports students’ ability to solve novel problems, so peer instruction can be an effective tool to generate new knowledge through peer discussion and improve student understanding and metacognition (Tullis et al., 2020). The call for assessment driven by learning theory is not new. However, it has gone unheeded because the science of educational measurement (or assessment) and the science of learning and cognition developed separately. This opinion states the importance of unifying assessment and learning. The most important factor influencing learning is what students already know, so teachers must ensure this and teach accordingly. This means the idea of unifying assessment and learning has been around for

https://doi.org/10.17509/jik.v21i3.72173

a long time, but its implementation is complex. Efforts to bring together the two fields, namely the science of educational measurement (or assessment) and the science of learning, are relatively new and have not been included in accountability assessments significantly.

Assessment is crucial for success in a differentiated classroom because of the dynamic relationship between differentiated instruction and assessment. The role of differentiated assessments in supporting differentiated instruction is evident because they facilitate the instruction process. This shows that assessment and instruction cannot be separated. Learning mathematical modeling is promising at SMKN 1 Sungai Menang and schools in Indonesia. It is also essential for teachers to implement real-world-based learning (Riyanto, 2021). This research still focuses on learning and not the implementation of assessments. In the practical implementation of mathematics teaching in the future, we view that symbol sense abilities can be developed not only through the topic of simple systems of equations but also the application of systems of equations in mathematics, other subjects, or everyday life (Al Jupri et al., 2024). Teachers must use different assessment methods to comprehensively understand their students' learning progress (Syaifuddin, 2019). If the goal is to see whether a school is progressing, then assessment and certification tools are essential. When we seek to improve the quality of schools to enhance student learning, assessment, and instructional tools are the keys to success. All instruction aims to modify long-term memory (Kirschner et al., 2018). Instruction and assessment are viewed as a unified activity and intervention mediating the learner's journey in the zone of proximal development. The fact that differential delivery of instructional guidance can be used to explain problem-solving skills fully emphasizes the importance of long-term memory for cognition. Authentic problems that open to multiple solutions provide teachers with opportunities to document students' mathematical development. We are experts in a field because our long-term memory contains a lot of information about that field (Kirschner et al., 2018).

Authentic assessments must also include clear instructions, meet pre-planned and announced objectives, and be aligned with preparatory activities equipped with digital tools throughout the semester (aligning technology, pedagogy, and context) (Barkah, 2024). This shows that education goals in the knowledge era have changed, requiring new perspectives in instruction, learning, and assessment. Therefore, for learning to occur, the learner must activate previous knowledge, relate new information/experiences, and restructure it accordingly. To carry out a crucial assessment role. New perspectives on instruction, learning, and assessment are also rooted in new theories of human intelligence that emphasize the multidimensional nature of this construct and the fact that it should not be treated as a fixed entity. If nothing changes in long-term memory, nothing is learned. This shows a unified relationship between assessment, instruction, and learning. Learning activity sheets enhanced with differentiated assessment techniques can be used in the classroom to improve student academic performance (Ihalon, 2022). Differentiated assessment types are fun, less stressful, and improve learning (Ihalon, 2022). Students who were given differentiated assessments in Mathematics experienced increases in academic achievement and levels of self-efficacy that were much higher than students who were given non-differentiated assessments (Saligumba & Segumpan, 2019).

Traditionally, learning has been conceptualized as memorizing facts, mastering procedures, and gaining competence to apply this knowledge to new problems or problems (Skulmowski, 2023). In other words, traditionally, learning has been conceptualized as memorizing facts, mastering procedures, and gaining competence to apply this knowledge and procedures to problems that are similar or slightly modified. The information provided is clear enough so that students remember enough facts and procedures to solve this problem. There is a large body of research on whether it is possible to promote deep learning approaches, where assessment is often seen as the answer (Nieminen et al., 2019).

Developing students' abilities to use mathematics in life has been recognized internationally. The mathematical modeling competency of students is not enough, and although students perform well in mathematics, they underachieve in other sub-competencies, especially in interpreting and validating.

https://doi.org/10.17509/jik.v21i3.72173

Thus, mathematics teachers should pay attention to and instill students' mathematical modeling competence since elementary school, as well as increase students' awareness of applying mathematics to solve problems in the real world. Students need ample opportunities to connect the real world and the world of mathematics through modeling and application (Nguyen & Tran, 2024). Modeling learning can promote mathematical modeling literacy. Repeated findings show that modelers struggle to transition between the mathematical and real worlds. This illustrates that research on modeling learning is crucial. Any instructional recommendations that do not or cannot determine what has been changed in long-term memory or that do not increase the efficiency of storing relevant information or retrieving it from long-term memory will be ineffective (Kirschner et al., 2018; Thaariq et al., 2023). Constructivist approaches to instruction are based in part on concerns that individual differences moderate the impact of instruction. This shows the importance of mathematical modeling instruction using process student worksheets. Implementing school-based assessment reforms that support student learning presents significant tensions in test-driven school cultures (Oo et al., 2024). So, it is crucial to carry out this research. So, the research aims to produce a mathematical modeling process worksheet to unify assessment, instruction, and learning.

LITERATURE REVIEW

Assessment

Although we may be able to master a test, we will soon forget the information. This suggests that the test has weaknesses that should be redesigned. The results of this research illustrate the importance of using test results formatively. For learning to be accessible and lasting, it must be meaningful and connected to other things we know. When learning is not linked to previous knowledge, the brain does not know how to store it or categorize it into memory. Also, work and non-work life increasingly require resources beyond textbook problem-solving (Krause et al., 2021). This is how assessment is crucial. Authentic assessment of 21st-century skills will help prepare learners to face challenges and succeed in the modern era of dynamics and complexity (Marwa *et al.*, 2024). So, assessment activities should be integrated into the instruction process (formative evaluation) and product (summative evaluation). However, the strengths and limitations of tests result from their adherence to learning and measurement theories that fail to capture the breadth and richness of knowledge and cognition. Most assessments provide a “snapshot” of achievement at a specific time, but they do not capture the development of students' conceptual understanding over time, which is central to learning. Summative assessments, the most common form of assessment, are primarily used to assign students scores on effort in exam content and are typically conducted in supervised, time-limited assessment environments.

Like authentic assessment, authentic assessment is a reaction to the perceived shortcomings of traditional approaches to testing. Various assessment tools are often recommended as good practice in response to criticisms of over-reliance on traditional tests and their shortcomings. In fact, over the past decade, the way we understand the purpose and function of assessment has changed. Teaching and learning outcomes improve when summative assessments are changed to non-proctored exam conditions. However, the worldwide dominance of tests and quizzes has been reported at various levels of education in North and South America, Africa, Asia (Zhao et al., 2018) and Europe (Iannone & Simpson, 2021). Educational systems are often built on artificial separation between subjects, focusing on developing abstract disciplinary knowledge divorced from real-world complexities. Traditionally, learning is associated with acquiring knowledge, while creativity, at least in its initial stages, is associated with the experience of uncertainty. Past discussions about learning and uncertainty are considered a stepping stone, a transitional stage that must be overcome when learning is completed. We need to learn something new and create things or procedures that we have never used before. Experts reject a 'parrot-like' approach to teaching or rote learning and instead advocate an approach that would pay attention to the whole child's

https://doi.org/10.17509/jik.v21i3.72173

intellectual, physical, and emotional growth through experience, child-centered learning, and play. It is highly recommended that students continue to carry out learning/assessment and research on mathematical modeling using interesting, meaningful, challenging contexts to improve their mathematics learning (Riyanto, 2022).

Assessment and instruction are connected.

Practitioners need learning opportunities to use classroom assessment to support learning, and without this, schools will not be able to improve. Teachers should pay attention to adjusting the level of cognitive load through their instructional design to facilitate students' instrumental help-seeking, thereby promoting learning engagement (Dong et al., 2020). Despite warnings and suggestions, the principles of assessment and classroom instruction remain largely separate, and teachers continue to use assessments that measurement experts say are inconsistent with best practices. Worksheets can provide an overview of the first phase that must be passed when solving a problem and instructions or practical rules that can help complete each phase successfully. A way to guide instruction is the use of process worksheets. Students receiving guidance through process worksheets outperform those left to find appropriate procedures themselves. Most educational systems throughout history and the world include acquiring specific knowledge as their ultimate goal. This approach to correct answers has received a lot of criticism over time for not encouraging critical and creative thinking. Schooling is based on the implicit assumption that those who follow and are willing to learn will obtain helpful information about the world, which has been tested, verified, and proven true.

Efforts to connect assessment and learning

Many researchers interested in educational assessment issues argue that combining cognitive science and measurement advances can provide a solid basis for overhauling educational assessment.

Unification of assessment, instruction, and learning through mathematical modeling

Students are exposed to an environment where they can learn according to their wishes; their creativity will increase, thus allowing them to think outside the box and create meaningful learning outcomes designed based on their type of intelligence (Dunlop, 2018). Only through assessment can we know whether a particular series of instructional activities has produced the expected learning outcomes. Unfortunately, there are no laws and few theories linking teaching and learning. Mathematical modeling is cognitively demanding (Lu & Kaiser, 2022a). Openness to modeling makes modeling an activity directed at creativity because it requires and increases mental flexibility and provides opportunities to generate original ideas (Klein & Leikin, 2020). One of the characteristics of inquiry-based teaching is the generation of uncertainty (Schijndel et al., 2018), manifested in the possibility of collecting different information, using different methods, and obtaining different results. To better understand and manage the world in which we live, the ability to reason with big data must be cultivated (Gafny & Ben-Zvi, 2023). In China, whether elementary or middle school students ' performance in mathematical modeling is inadequate, which may be due to the test-oriented nature of Chinese mathematics education (Lu & Kaiser, 2022b). Students can apply the modeling process, promoting their modeling literacy (Riyanto et al., 2019). There currently seems to be no point in training teachers to teach mathematics if their teaching does not impact our time's significant challenges and transformations (Alsina, 2023). Creative learning focuses on developing a creative identity that does not focus on compliance and conformity but rather a creative identity that identifies and accepts the chaos/messiness inherent in the process). Mathematics teachers should focus

https://doi.org/10.17509/jik.v21i3.72173

on developing students' mathematical modeling competencies from elementary school to college so that they can better solve various non-conventional problems in the real world.

METHODS

This research used development research developed by Akker, Gravemeijer, McKenney, and Nieveen. This approach used three phases: analysis, design, and evaluation (Zulkardi et al., 2020). The analysis phase includes analysis of students, instruction, curriculum, assessment, learning, real-world situations, principles, and characteristics of mathematical modeling problems. The design phase, namely designing questions and worksheets for the mathematical modeling process using the context of out-of-town travel to integrate assessment, instruction, and learning. The formative evaluation phase consists of self-evaluation, one-to-one, expert review, small group, and field tests (Zulkardi et al., 2020). **Figure 1** shows the formative assessment.

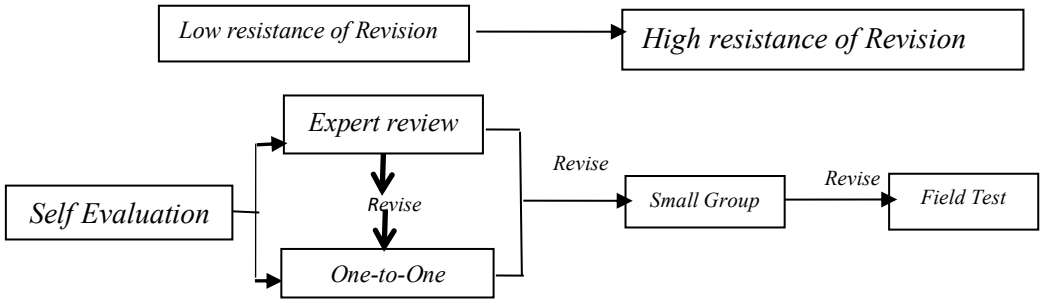


Figure 1 Formative evaluation design
Source: Zulkardi et al., (2020)

The research only discusses the self-evaluation, expert review, and one-to-one phases. The success criteria for this research is to produce a mathematical modeling process worksheet using a valid out-of-town trip context for unifying assessment, instruction, and learning. Validity results from expert review by Prof. Yan Zi (Educational assessment expert), Dr. Duano Sapta Nusantara (Realistic Mathematics Expert, Sriwijaya University, Indonesia, and Dr. Sumardiono (Mathematics education expert, SEAMEO Qitep) and student solutions and comments on a one-to-one. One student of SMKN 3 Kayuagung, Rici Andewo, class X multimedia was the research subject. Data is analyzed by descriptive analysis method, namely (1) Walkthrough, with an analysis of the worksheet based on expert comments to produce a mathematical modeling process using the context of the outdoors for the unifying of assessments, instructions, and learning (2) One-to-one review, analysis student opinions to analyze one-to-one results.

RESULTS AND DISCUSSION

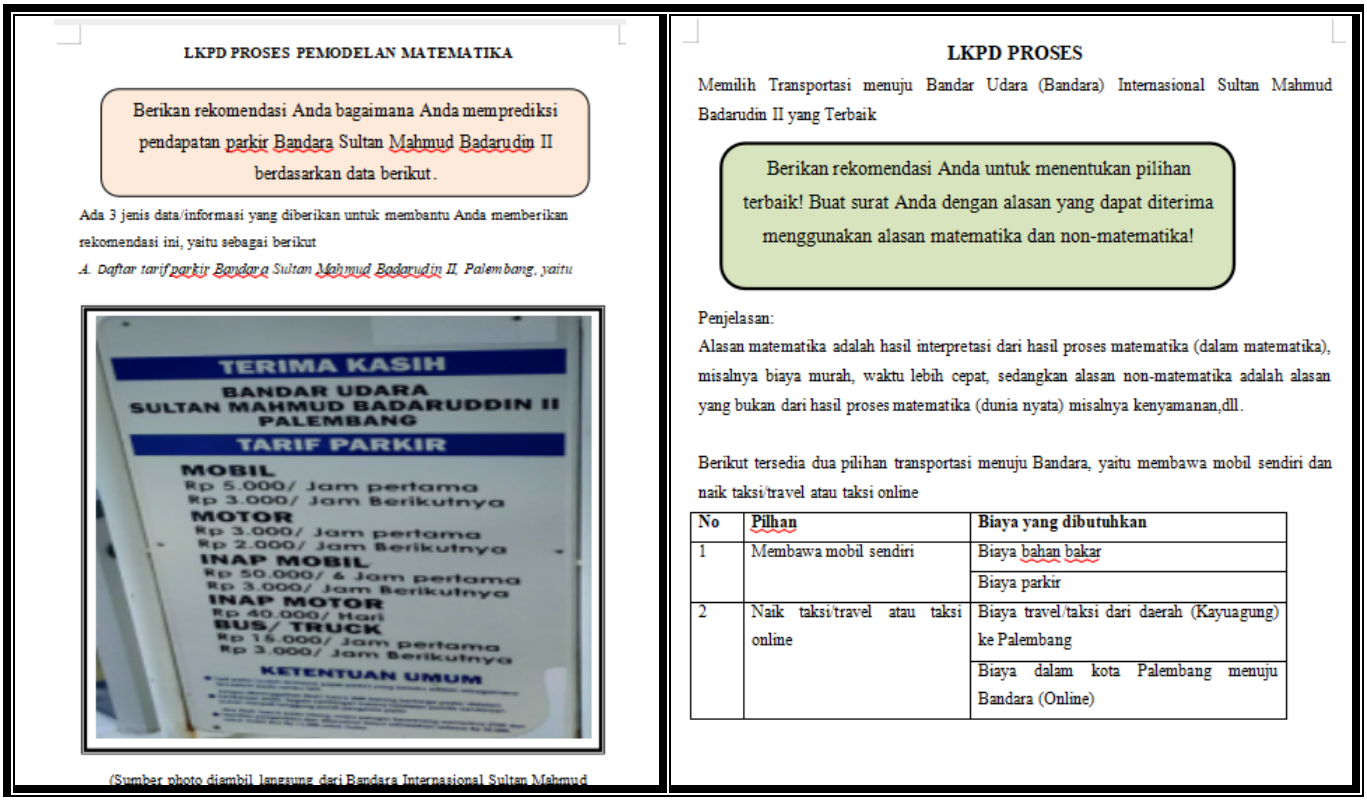
Analysis Stage

The analysis includes curriculum analysis, student needs, real-world context, and characteristics and principles of mathematical modeling, assessment, and learning in Vocational Secondary Schools. This research used the characteristics and principles of mathematical modeling questions to unify assessment, instruction, and learning.

https://doi.org/10.17509/jik.v21i3.72173

Design Stage

Researchers look for real-world problems and develop instructional modeling processes using out-of-town trips. They developed this process worksheet following the characteristics, principles, modeling, and assessment cycles. **Figure 2** shows the design stage.



LKPD PROSES PEMODELAN MATEMATIKA

Berikan rekomendasi Anda bagaimana Anda memprediksi pendapatan parkir Bandara Sultan Mahmud Badarudin II berdasarkan data berikut.

Ada 3 jenis data/informasi yang diberikan untuk membantu Anda memberikan rekomendasi ini, yaitu sebagai berikut

A. Daftar tarif parkir Bandara Sultan Mahmud Badarudin II, Palembang, yaitu

(Sumber photo diambil langsung dari Bandara Internasional Sultan Mahmud

LKPD PROSES

Memilih Transportasi menuju Bandar Udara (Bandara) Internasional Sultan Mahmud Badarudin II yang Terbaik

Berikan rekomendasi Anda untuk menentukan pilihan terbaik! Buat surat Anda dengan alasan yang dapat diterima menggunakan alasan matematika dan non-matematika!

Penjelasan:
Alasan matematika adalah hasil interpretasi dari hasil proses matematika (dalam matematika), misalnya biaya murah, waktu lebih cepat, sedangkan alasan non-matematika adalah alasan yang bukan dari hasil proses matematika (dunia nyata) misalnya kenyamanan,dll.

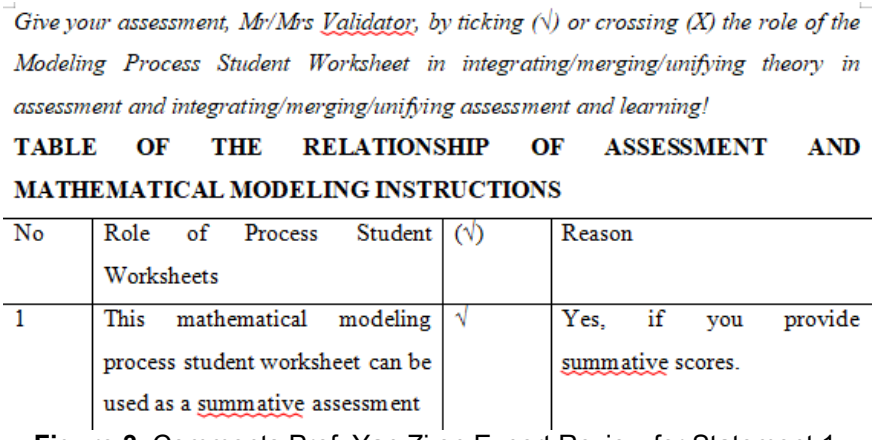
Berikut tersedia dua pilihan transportasi menuju Bandara, yaitu membawa mobil sendiri dan naik taksi/travel atau taksi online

No	Pilhan	Biaya yang dibutuhkan
1	Membawa mobil sendiri	Biaya bahan bakar
		Biaya parkir
2	Naik taksi/travel atau taksi online	Biaya travel/taksi dari daerah (Kayuagung) ke Palembang
		Biaya dalam kota Palembang menuju Bandara (Online)

Figure 2. Design stage result
Source: Taken from a process worksheet designed by the author, 2024

Formative Evaluation Stage

This step includes self-evaluation, expert review, and one-to-one review. An Expert Review from Prof. Yan stated that this Modeling Process Student Worksheet can be used as a summative assessment. This can be done because after students receive feedback from the teacher or friends regarding their work on the Process Student Worksheet, they will improve it according to the feedback and then submit it back to the teacher to be used as a portfolio, which will be given a summative score for the report. **Figure 3** shows expert comments.



Give your assessment, Mr/Mrs Validator, by ticking (√) or crossing (X) the role of the Modeling Process Student Worksheet in integrating/merging/unifying theory in assessment and integrating/merging/unifying assessment and learning!

TABLE OF THE RELATIONSHIP OF ASSESSMENT AND MATHEMATICAL MODELING INSTRUCTIONS

No	Role of Process Student Worksheets	(√)	Reason
1	This mathematical modeling process student worksheet can be used as a summative assessment	√	Yes, if you provide summative scores.

Figure 3. Comments Prof. Yan Zi on Expert Review for Statement 1
Source: Taken from a process worksheet designed by the author, 2024

https://doi.org/10.17509/jik.v21i3.72173

Prof. Yan stated that Student Worksheets can be used as formative assessments provided they provide feedback for future learning. This worksheet can allow feedback from peers or teachers because this worksheet provides a modeling process that can allow students to have different ways of thinking in solving problems in this worksheet, such as simplifying problems, making assumptions, creating mathematical models, and carrying out mathematical calculations. Students can provide feedback mathematically and in the real world (outside mathematics). Expert comments are shown in **Figure 4**.

	This mathematical modeling process student worksheet can be used as a formative assessment	Depends on…	Yes, if you provide feedback to students for future learning. But the problem is that the worksheet itself does not promise feedback. In other words, it is not the worksheet that determine whether you are doing summative or formative assessment, but the way you use the worksheet. For example, if you use the worksheet to give a final score to students, then it is a summative assessment; but if you provide feedback to students according to their performance on the worksheet, then it is formative assessment.

Figure 4 Comments Prof. Yan Zi on Expert Review for Statement 2
Source: Taken from a process worksheet designed by the author, 2024

Prof. Yan stated that this process worksheet can unite/integrate formative and summative assessments if it provides summative scores and learning feedback. This process worksheet can be given a summative score because students can improve it after receiving feedback from peers and teachers. This shows that this process worksheet can unify the assessment. Expert comments are shown in **Figure 5**.

3	Student Worksheets in this mathematical modeling process can integrate/unite/combine summative and formative assessments	Depends on…	Yes, if you provide both summative scores and learning feedback.

Figure 5 Comments Prof. Yan Zi on Expert Review for Statement 3
Source: Taken from a process worksheet designed by the author, 2024

Prof. Yan stated that this Student Worksheet process can unify assessment and learning if it provides a summative score and learning feedback. This process worksheet can be given a summative score

https://doi.org/10.17509/jik.v21i3.72173

because students can improve it after receiving feedback from peers and teachers. This shows that this process worksheet can unite assessment and learning or allow assessment and learning to co-occur. Expert comments are shown in **Figure 6**.

4	Student Worksheets in this mathematical modeling process can integrate/unite/combine assessment and learning	Depends on…	Yes, if you provide both summative scores and learning feedback.

Figure 6 Comments Prof. Yan Zi on Expert Review for Statement 4
Source: Taken from a process worksheet designed by the author, 2024

Duano comments are shown in **Table 1**.

Table 1. Expert comments on process worksheets

Document	Revisions
Informasi pada gambar dan tabel ada baiknya tidak overlapping, sehingga membuat siswa bingung, justru menariknya adalah bagaimana membuat siswa membaca dan menganalisis informasi pada gambar. Sebaiknya hapus pada tabel, cukup tampilkan pada gambar. Pada gambar, ada baiknya, di crop, sehingga focus pada informasi biaya parkir.	*Delete typing data and only display the parking rate image.*
Komentar lainnya: **1. Informasi pada tabel dan gambar terkesan overlapping, sehingga sebaiknya informasi yang ada pada tabel dihapuskan. Biarkan siswa membaca dan menganalisis sendiri data yang ada pada gambar.** **2. Sumber foto perlu ditambahkan, apakah gambar pribadi atau informasi dari website resmi, ini menunjukkan karakteristik soal pemodelan yang OTENTIK.** **3. Untuk beberapa foto struk parkir perlu di crop, agar menjadi fokus** **4. Apakah ini LKPD? Sebaiknya ditambahkan petunjuk belajar, capaian pembelajaran, topik apa dan informasi penting lainnya. Ini yang membedakan antara LKPD dan soal pemodelan.**	*Photo sources are provided, process worksheets plus learning instructions, learning outcomes, topics, and other important information (such as scaffolding)*
5. Konteks yang menarik dengan gambar yang menarik, mengajak anak untuk berfikir secara matematis. Namun, perlu ada guidelines atau perlu intervensi agar scope tidak meluas sehingga capaian pembelajaran dapat diukur sesuai dengan konten yang diajarkan. Bisa juga ditambahkan petunjuk berupa 7 langkah proses pemodelan matematika. Karakteristik soal pemodelan memang TERBUKA namun terukur (bisa memiliki banyak Solusi atau memiliki banyak cara dalam penyelesaiannya). **6. Perlu diperbaiki dalam hal mengkonstruksi LKPD, sebagai contoh: Berikan konteks sebagai starting, tambahkan informasi penting dan pendukung dari konteks tersebut, dilanjutkan dengan pertanyaan. (Pertanyaan ada di akhir). Ini untuk mempermudah siswa dalam memahami soal yang diberikan.** **7. Perlu ditambahkan instrument pendukung lainnya seperti: rubrik, pedoman penskoran, dll.** **8. Ubah redaksi kalimat pertanyaan: Berdasarkan data di atas, bagaimana Anda memprediksi pendapatan parkir Bandara Sultan Mahmud Badarudin II. Tunjukkan perhitungan matematismu.**	*The context is interesting: creating a rubric and changing the editorial team.*

Source: Taken from expert comments, 2024

Sumardiono comments are shown in **Table 2**.

Table 2. Expert comments on process worksheets

Document	Revision
sumardyono sum… Apa yang dimaksud dengan "surat"?	The letter explains that the letter is a recommendation from the student regarding transportation options.

https://doi.org/10.17509/jik.v21i3.72173

Document	Revision
sumardyono sum... Apa tujuan (goal/objectives) dari LKPD ini? Apa yg dimaksud dg "terbaik". Hanya dari segi biaya? Bagaimana dengan waktu tempuh? Fleksibilitas (waktu tunggu, perpindahan barang, dll)? Atau lainnya?	To generalize the results, an explanation of the assumption that "best" is cheap, fastest, or most comfortable (no traffic jams) is given.
sumardyono sum... Jika yg dimaksud alasan non-matematis adalah keinginan orang yg melakukan perjalanan, maka ini sangatlah absurd karena tidak dapat dianalisis lebih lanjut. Keinginan itu sangat terbuka dan pribadi.	Provide more space for students according to the characteristics of mathematical modeling.
sumardyono sum... Akan lebih baik, jika titik mula diasumsikan sama. Atau masalah ini lebih bersifat masing2 siswa sesuai tempat tinggalnya?	The assumption used is from Kayuagung City.
sumardyono sum... Yang paling irit biaya?	It can be economical, fastest, or comfortable (no traffic jams), providing flexibility.
sumardyono sum... Ini sangat terbuka. Jika dipaksa, apakah tidak membuat rekomendasi menjadi "blur" (tidak pasti)?	Students are given flexibility.

Source: Taken from expert comments, 2024

The researcher revised the process worksheet based on the expert comments. One-to-one by Rici Andewo, this modeling problem makes you think about challenges and new ones. This shows that mathematical modeling questions, especially process worksheets as mathematical modeling instructions for unifying assessment, instruction, and learning, are crucial to continue to be developed. Students can decide on problems and have contributions in the form of ideas in providing recommendations but have not been able to make explicit assumptions and have not been able to do mathematics, where students can do mathematics informally. This indicates that the mathematical modeling instructions in process worksheets can be used to unify assessments, instruction, and learning. The figure shows the student solutions.

Expert Review

Assessment experts think that the mathematical modeling process can be used formatively with feedback from others. Students carry out self-assessments and make revisions, conveyed back through conferences between students and teachers, ultimately leading to summative assessment with grading. Instructions from teachers and peers are essential in the learning and assessment process. This can unite the assessment, process, and learning cycles. Experts state that the mathematical modeling process can unify assessment, instruction, and assessment if there is feedback and value. First, teachers continue to look for ways to improve students' academic achievement with teaching innovations such as differentiated assessment; research results suggest academic performance is achieved when this technique is in the classroom. Second, differentiated assessment is an essential tool in assessing students, as different assessments improve students' academic performance; the proposed improved learning activity sheet can help. In differentiated assessment, students are assessed based on their type of intelligence (Ihalon, 2022). The assessment after the activity verifies student growth and begins the instructional cycle again.

https://doi.org/10.17509/jik.v21i3.72173

Many activities can be carried out to differentiate assessment in the classroom, namely quizzes, tests, essays, portfolios, debates, projects, reports, schedules, demonstrations, maps, learning notes, stimulation, journals, graphic organizers, artificial rubrics, students, multimedia presentations, brochures, pamphlets, postcards, songs, peer evaluations, self-evaluations, models, exhibitions, assignments, games, etc.

The relationship between summative - and formative assessment is significant because formative assessment, in a certain sense, is voluntary, making it possible to teach without such assessment. In contrast, summative assessment cannot be avoided because student learning reports must be made and records kept regularly and periodically. This cannot be avoided and also cannot have an impact on the use of formative assessment. The language and practices of formative and summative/traditional assessment have become a key focus of contestation between two contrasting learning paradigms, namely the refusal to support formative assessment and the “new” learning and assessment paradigm, creating a (false) dichotomy in the literature.

One-to-One Review

The one-to-one results show that students can determine the problem to be solved and do mathematics informally; even though they have not done mathematics formally, students have demonstrated basic abilities in the work in the process worksheet. This is due to the scaffolding provided so that students have direct and strong direction and guidance in forming new knowledge, which results in storage in long-term memory. Thus, a learning process occurs within students, namely, learning that can be transferred. We have a limited working memory related to all conscious activities and an effective and unlimited long-term memory that can store schemas with varying degrees of automaticity. Intellectual skills originate from constructing many increasingly sophisticated schemas with a high level of intelligence and a degree of automaticity. Schemas bring together many elements that can be treated as one element and allow us to ignore a large number of irrelevant elements, working memory capacity is freed up, allowing processes to occur that would otherwise be burdensome working memory, and automatic schemes allow smooth performance on familiar aspects of the task and by freeing up working memory capacity allow levels of performance on unfamiliar aspects that might otherwise be impossible. Innovative assessment exists as a combination of various methods and techniques (new, contemporary, and 'old') that are united to improve the quality of student learning. It is essential to provide solid empirical research based on alternatives to ensure that assessment can drive the formative processes of students' lifelong learning (Wong et al., 2020).

The amount of information gained can be overwhelming, with one teacher likening it to negotiating a fast-flowing river, so an essential part of using assessment for learning is figuring out how to hone in on manageable alternatives. This is very compatible with big data. It is essential to do what sensors and the Internet of Things (IoT) have done for physical assets in other sectors, then match these behaviors (what the curriculum wants) with previously identified (observed) behaviors and have been linked to sub-construction so that assessments can be made very quickly and cheaply. Student learning situations can be evaluated, assessed, and analyzed using student learning data sets (Khan et al., 2022). Understanding big data is essential in education to determine the best strategy for the teaching and learning process, where data must be analyzed well (Hergiansa et al., 2020). Also, the time of this analysis is crucial because it determines any changes in the learning environment. Analysis of what is known as big data has been widely applied in various fields of life but is relatively new in education. So, using mathematical modeling instructions is very appropriate to overcome this. The use of big data also allows for student development from every aspect, so academic records and development data can be used as a reference and consideration when providing treatment and assessment processes to students. This statement is very suitable for this research, namely designing a combination of assessment, instruction, and learning for

https://doi.org/10.17509/jik.v21i3.72173

implementing Big Data through mathematical modeling learning. Investment is needed to develop new pedagogical approaches to harness the scale and possibilities of big data without losing sight of the complexity involved in creative thinking.

Indonesia and Hungary have the same challenges in education, such as students' fear of mathematics and the existence of conventional teaching traditions (Győri et al., 2020). To develop students' competence in mathematical modeling and increase their awareness of the application of mathematics, the following three aspects must be considered in mathematics teaching namely 1) mathematics teachers need to focus on the limitations of word problems in developing mathematical modeling competence, where although word problems can improve students' mathematical modeling competence, this problem has several limitations in the development of several sub-competencies, also elementary school students' difficulties in interpreting and validating are most likely caused by the fact that the results of word problems are often closed, 2) mathematics teachers must create situations for students to apply mathematics and guide them to use mathematics to solve real problems (Riyanto et al., 2019). In China, because teaching is still grade-oriented, mathematics teachers pay more attention to students' mastery of mathematical knowledge but lack understanding of how to use mathematics in real problems; 3) from the elementary school level, mathematics teachers must begin to instill awareness and ideas of mathematical modeling to students, where learning mathematical modeling can inspire elementary school students to use mathematical tools and lay the foundation for building more complex models in the future.

Discussion

The validation results have shown that the mathematical modeling process using process worksheets can unite assessment, process, and learning. Teachers find it challenging to achieve improved student learning without effective assessment for learning practices at all levels of the educational environment (Gebremariam & Gedamu, 2023). If you want to change student learning, then change the assessment method. Teachers have found that discovery learning is successful only when students have the necessary knowledge and have undergone some structured experience beforehand. Six instructional design principles, based on cognitive learning theory that can improve learning, namely reducing the load on limited working memory, activating existing knowledge structures, supporting the encoding and representation of new knowledge, facilitating "deep thinking", improving cognitive control processes, Supporting the use and transfer of knowledge and skills. The importance of feedback and structural support during assessment shows a need for teacher scaffolding/instruction so that learning occurs. The gap between instruction and assessment becomes blurred in classrooms that use assessment to support learning.

Assessment is something that all teachers are involved in because they are obliged to determine judgments and give grades. The pedagogical approach is not an optional activity but a fundamental aspect of a teacher's work life. In designing assessments, teachers take cues from their teachers and their perceptions of professional expectations. This shows that teacher assessment takes past and present experiences, not for the future, based on research results or assessment theory and their traditional perceptions that are unsuitable for now and in the future. The main implications for practice are 1) assessment must focus on developing effective student learning processes, and 2) well-designed summative questions have the potential to stimulate students' learning-oriented approaches. We must not distinguish neatly between formative and summative assessment but use assessment in various integrated ways, including some that can be categorized as formative with summative hints and summative with composition/components/formative bits. Teachers who use differentiated assessment are continuous assessors, assessing informal, formal, and varying assessment techniques from time to time, not just stating mastery directly, and learning questions and assessments are tailored to the needs and abilities of each student. Because historically, the two sets of professional standards (assessors and instructional

https://doi.org/10.17509/jik.v21i3.72173

developers) did not overlap, two interrelated problems arose. First, teachers spend a quarter to a third of their professional time engaged in assessment-related work without The essential training required to do it well. Second, test people who see their work as producing evidence of accountability have difficulty understanding or producing the results teachers need to inform the kinds of critical instructional decisions they face. Research reported that the research participants, because they had been encouraged to think more relationally, were slightly better able to apply what they learned in the explanation phase of the study to solving future problems (transfer tests) (Givvin et al., 2019). The assessment decision-making process provides a theoretical framework that allows assessment principles to be applied to improve instruction and student learning in the classroom. Teachers report an iterative feedback process to help students improve their production, even qualifying intermediate stages (Balbia et al., 2022).

The one-to-one results also showed that mathematical modeling instruction led to students being able to solve real-world problems on their own. The role of worksheets as scaffolding also shows that students follow problem-solving based on the width of the modeling process work. So, this is very important for the modeling cycle and assessment cycle. We do not have a definitive example of an institutional culture that unifies assessment, curriculum, and instructional practices to improve student learning. If we want all assessments to aid learning, this must guide decisions about how summative assessment is conducted. Such weighted final exams are problematic from a learning perspective. We must test our students for various reasons; such testing should help guide instruction. In China, because teaching is still grade-oriented, mathematics teachers pay more attention to students' mastery of mathematical knowledge but lack understanding of how to use mathematics in real problems. This can unite assessment, instruction, and learning. Knowledge without context in behaviorism does not provide a convincing explanation of how new knowledge in the world is created. Teaching mathematics in schools with abstract concepts and memorized rules will have a negative impact on students' interest and performance in mathematics. The mathematical modeling assessment approach is designed to provide feedback regarding individual learner performance and the problems themselves, thereby identifying professional development needs for teaching mathematical modeling and applications (Alagoz & Ekici, 2020). Lifelong learning requires people to learn new things continually, but it tends to be much more difficult to unlearn and re-learn when contexts and paradigms change. For elementary school students, mathematical modeling differs from traditional school mathematics, emphasizing speed and accuracy. Fictional creations are created by teachers and carry preconceived expectations of solutions that students must express. Thus, students focus on the teacher's thoughts, not the problem. It is essential to continue developing learning/assessment and mathematical modeling research in the future to create quality learning per the Independent Curriculum (Riyanto, 2022).

Mathematical modeling is more challenging and motivating and encourages students to generate mathematical ideas (English, 2021). Teachers using a formative assessment approach guide students in developing their own “learning to learn” skills—being flexible and curious in learning current ideas and problem-solving methods—which are increasingly necessary as knowledge quickly becomes outdated in today's information environment, which is easy to change. Referring to the role of mathematics in solutions related to the great crises of our time, This crisis cannot be resolved with mathematics alone but rather through various scientific disciplines (Alsina, 2022). Knowledge of various types must be integrated to face and overcome current challenges (Alsina, 2023).

Everything students do, such as conversing in groups, completing sit-down work, answering and asking questions, working on projects, turning in homework, and even sitting quietly and looking confused, is a potential source of information about how much they understand. For an excellent educator, continuously gathering information about students' growth in different ways is normal. In small progressive schools where attention can be paid to each student, and standardized assessments are not given, the younger generation is evaluated in terms of their development as learners. Assessment of student achievement is

https://doi.org/10.17509/jik.v21i3.72173

changing, especially because today's students face a world that demands new knowledge and abilities and the need to become lifelong learners in a world that demands competencies and skills that have not yet been defined. It is time to move beyond the obsessive belief that we can improve schools by demanding higher test scores. Almost all tests are used for accountability purposes. Typically, test tools do not function well as instructional tools, and their users do not understand this. Assessment by examination has become an inseparable part of the teaching and learning process in the global education system. Traditional assessment perspectives, based on behaviorist learning theory, "scientific measurement," and conventional psychometric principles (i.e., principles that are important for large-scale standardized objective tests) conflict with the implications for classroom assessment that comes from a more contemporary view of learning represented by cognitive, constructivist, and interpretive paradigms. So, there needs to be a change in the assessment. Constructive alignment is everything in the curriculum, namely learning outcomes, learning and teaching methods, and assessment methods that must follow each other and be seamless, proven to be interrelated (Riyanto, 2022). It is essential to create a positive and supportive classroom climate that focuses on student growth and not just grades (Nasir et al., 2024). Performance assessments, portfolios, authentic assessments, and student self-assessments have been promoted as procedures that align assessment with current constructivist theories of learning and teaching. The existence of big data in the scope of education is essential because it provides many valuable aspects (Hergiansa *et al.*, 2020).

The traditional approach to instruction and assessment involves teaching specific material and determining who has and has not learned it at the end of the teaching, similar to the quality control approach in manufacturing. Teacher-controlled mathematics instruction dominates classrooms and influences feedback, opportunities for students to use feedback in a given context, and student agency (Sandal et al., 2024). Assessment for learning involves adjusting teaching according to needs while learning is still ongoing, namely a quality assurance approach. Some educators believe that the new system places too much emphasis on standardized testing and limits their ability to adapt lessons to student needs (Nasir *et al.,* 2024). Classroom assessments are essential in measuring student understanding, informing instructional decisions, and promoting learning (Baidoo-Anu *et al.*, 2023). Questions are carefully designed to balance required skills and abilities, ensuring that students with different skill levels and disciplinary backgrounds can effectively engage and benefit from the course. Society should be protected from graduates who cannot achieve the expected standards. Students who are evaluated favorably by their peers develop high self-esteem among their classmates (Ambarokah & Sinaga, 2023). Learners with high working memory capacity benefit more from collaborative learning than individual learning (Du et al., 2022). Therefore, it is essential to unify assessment, instruction, and learning.

Figures 7, 8, and **9** show the findings of this research on unifying assessment, instruction, and learning as a single event.

https://doi.org/10.17509/jik.v21i3.72173

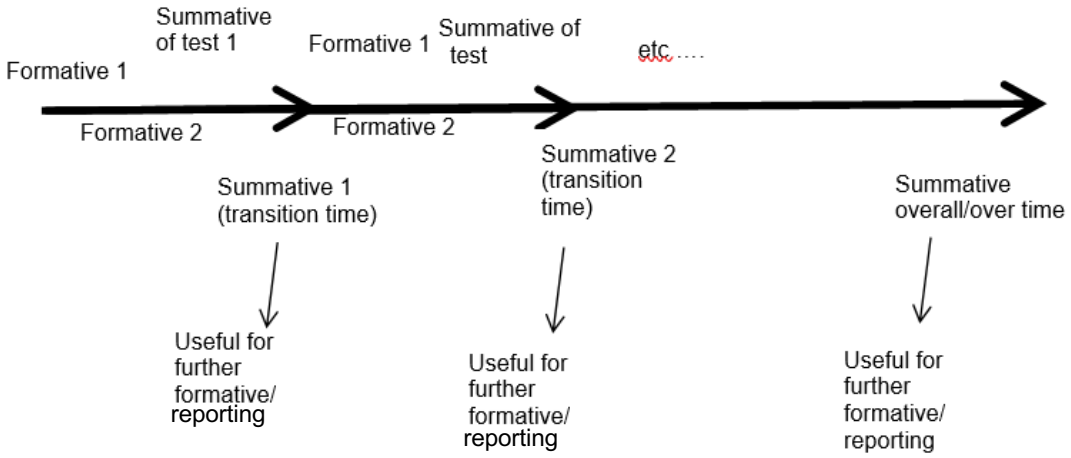


Figure 7. Process Scheme for unifying assessment and instruction, learning and assessment
Source: Designed by the author, 2024

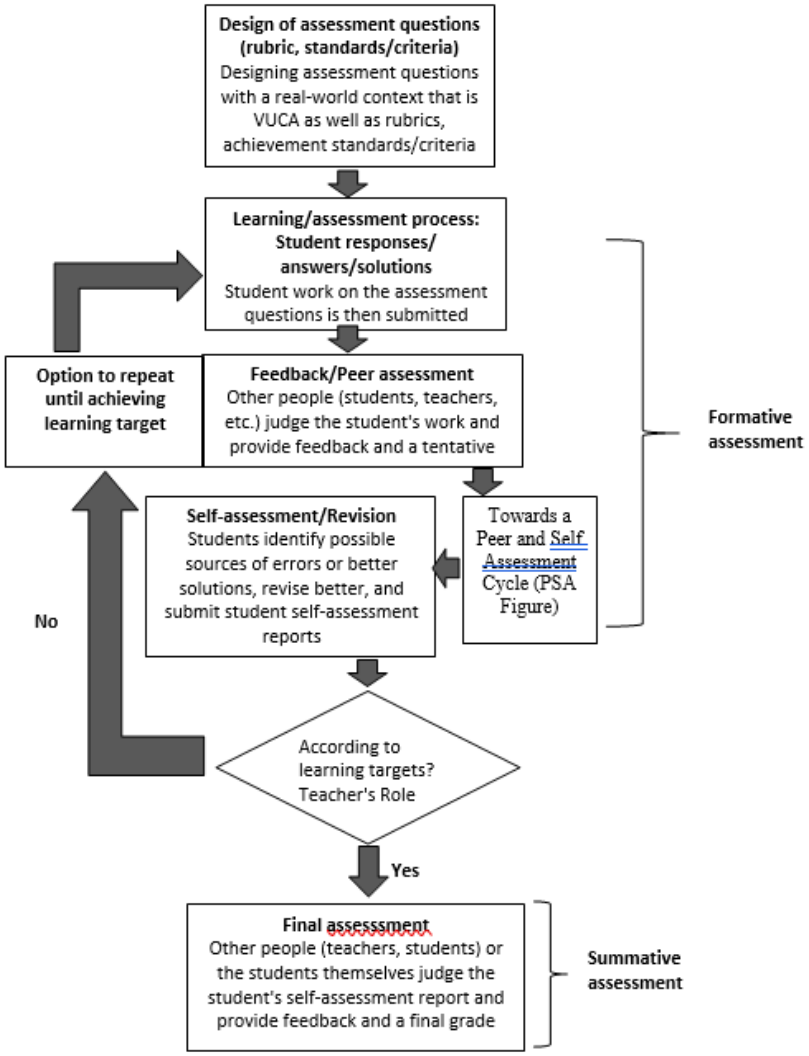


Figure 8. Unifying of assessment, instruction, and learning (UAIL)
Source: Designed by the author, 2024

https://doi.org/10.17509/jik.v21i3.72173

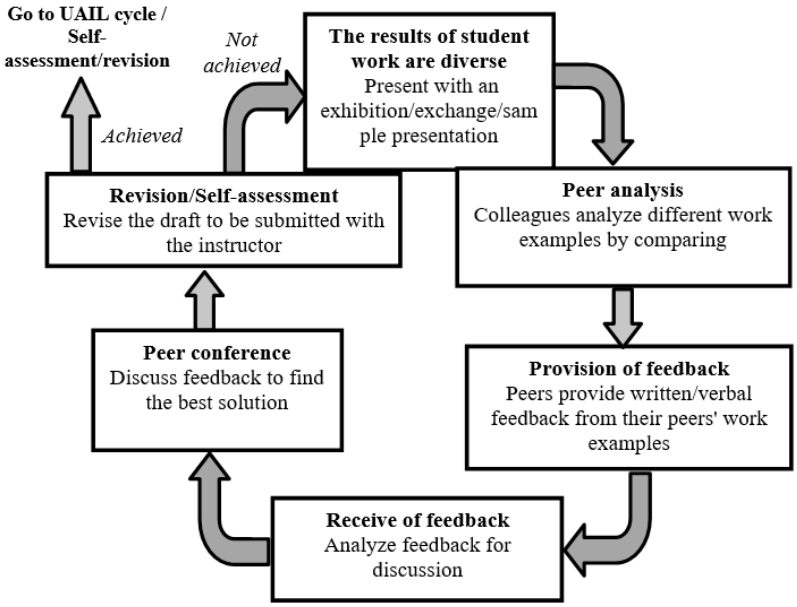


Figure 9 PSA (Peer and self-assessments are cyclical)
Source: Taken from a process worksheet designed by the author

CONCLUSION

Research has produced mathematical modeling process worksheets using the context of out-of-town travel to unify assessment, instruction, and learning. These results support assessment as a "Union of Insufficiencies" because no one or two assessment tools can provide an accurate picture of a learner, and a "Union of Insufficiencies" provides a more complete picture of a student as a learner than one type of assessment which is used separately/isolated. Future research recommends wide use of mathematical modeling process worksheets using other contexts or real-world problems for other subjects to strengthen the unifying of assessment, instruction, and learning. Also, use video work examples/modeling examples for mathematical modeling or other subjects.

AUTHOR'S NOTE

The author declares that there is no conflict of interest regarding the publication of this article and confirms that the data and content of the article are free from plagiarism.

REFERENCES

Alagoz, C., & Ekici, C. (2020). Cognitive diagnostic modeling for mathematical modeling assessment. *Mathematical Modeling Education and Sense-Making*, *30*(1), 349-359.

Al Jupri, Usdiyana, D., Gozali, S. M. (2024). Teaching and learning processes for pre-service mathematics teachers: The case of systems of equations. *Eurasia: Journal of Mathematics, Science and Technology Education*, 20(8), 1-14.

Ambarokah, L., & Sinaga, F. S. S. (2023). Implementation of the peer assessment evaluation model at MTS Ma'arif NU Cilongok. *Inovasi Kurikulum, 20*(1), 117-128.

Alsina, Á. (2022). On integrating mathematics education and sustainability in teacher training: why, to what end and how? In D. Ortega-Sánchez (Ed.), controversial issues and social problems for an integrated disciplinary teaching. *Integrated Science, 8*(1), 9-21.

https://doi.org/10.17509/jik.v21i3.72173

Alsina, Á. (2023). Mathematics Teacher Education for Sustainability (MTEfS): An emerging research agenda. *AIEM - Avances de Investigación en Educación Matemática, 23*(1), 1-4.

Baidoo-Anu, D., Rasooli, A., DeLuca, C., & Cheng, L. (2023). Conceptions of classroom assessment and approaches to grading: Teachers' and students' perspectives. *Education Inquiry, 14*(1), 1-29.

Baig, M. I., & Shuib, E. & Yadegaridehkordi, E. (2023). Big data in education: A state of the art, limitations, and future research directions. *International Journal of Educational Technology in Higher Education, 17*(44), 1-23.

Balbia, A., Bonillaa, M., Otamendia, M. A., Curionec, K., & Beltrán-Pellicerd, P. (2022). Formative assessment and mathematics education: The perspective of in-service mathematics teachers. *Acta Sci. Canoas, 24*(6), 236-268.

Barkah, T. (2024). Authentic assessment in intensive training (bootcamp) of higher education students as well as feedback on the learning experience process. *Inovasi Kurikulum, 21*(1), 267-286.

Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in education: Principles, Policy & Practice*, *25*(6), 551-575.

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.

Deva, S., Nurpatihah S, F., Ayuni, A. D., Apriana, W. S., & Nahadi, N. (2024). Analysis of performance assessment on Kurikulum Merdeka and Kurikulum 2013. *Inovasi Kurikulum*, *21*(2), 1193-1204.

Dong, A., Jong, M. S. Y., and King, R. B. (2020). How does prior knowledge influence learning engagement? The mediating roles of cognitive load and help-seeking. *Front. Psychol, 11*(1), 1-10.

Dunlop, P. (2018). Differentiating assessment in high school. *BU Journal of Graduate Studies in Education, 10*(2), 14-17

Du, X., Chen, C., and Lin, H. (2022). The impact of working memory capacity on collaborative learning in elementary school students. *Front. Psych,13*(2), 1-12.

English, L. D. (2021). Mathematical and interdisciplinary modeling in optimizing young children's learning. *Exploring Mathematical Modeling with Young Learners*, *30*(3), 3-23.

Gafny, R., & Ben-Zvi, D. (2023). Students' articulations of uncertainty about big data in an integrated modeling approach learning environment. *Teaching Statistics, 45*(1), 67-79.

Gebremariam, H. T., & Gedamu, A. D. (2023). Primary school teachers' assessment for learning practice for students' learning improvement. *Front. Educ, 8*(1), 1-10.

Givvin, K. B., Moroz, V., Loftus, W., & Stigler, J. W. (2019). Removing opportunities to calculate improves students' performance on subsequent word problems. *Cognitive Research: Principles and Implications, 4*(2), 1-13.

Guo, W.Y., & Yan, Z. (2019). Formative and summative assessment in Hong Kong primary schools: Students' attitudes matter. *Assessment in Education: Principles, Policy & Practice, 26*(6), 675-699.

Gordon Győri, J., Fried, K., Köves, G., Oláh, V., & Pálfalvi, J. (2020). The traditions and contemporary characteristics of mathematics education in Hungary in the post-socialist era. *Eastern European Mathematics Education in the Decades of Change, 1*(1), 75-129.

Hergiansa, G. A. F., Widuri, S. S., & Hadiapurwa. (2020). Pemanfaatan big data dalam lingkup pendidikan. *Inovasi Kurikulum, 17*(2), 109-116.

Iannone, P., & Simpson, A. (2022). How we assess Mathematics degrees: The summative assessment diet a decade on. *Teaching Mathematics and its Applications: an International Journal of the IMA, 41*(1), 22-31.

https://doi.org/10.17509/jik.v21i3.72173

Ihalon, E. C. (2022). Differentiated assessment in Araling Panlipunan 10: Enhanced learning activities. *International Journal of Trend in Scientific Research and Development (IJTSRD)*, *6*(6), 971-986.

Kasmi, H. & Anasse, K. (2023). The status of alternative assessment in Morocco: Teachers' attitudes and obstacles. *International Journal of Language and Literary Studies, 5*(1).300-311.

Khan, M. A., Khojah, M., & Vivek. (2022). Artificial intelligence and big data: The advent of new pedagogy in the adaptive e-learning system in the higher educational institutions of Saudi Arabia. *Education Research International,10(*1), 1-10.

Kirschner, P. A., Sweller, J., Kirschner, F., & Zambrano R, J. (2018). From cognitive load theory to collaborative cognitive load theory. *International Journal of Computer-Supported Collaborative Learning, 13*(1), 213-233.

Klein, S., & Leikin, R. (2020). Opening mathematical problems for posing open mathematical tasks: What do teachers do and feel?. *Educational Studies in Mathematics*, *105*(3), 349-365.

Krause, C. M., Di Martino, P., & Moschkovich, J. N. (2021). Tales from three countries: Reflections during COVID-19 for mathematical education in the future. *Educational Studies in Mathematics*, *108*(1), 87-104.

Lam, R. (2019). Teacher assessment literacy: Surveying knowledge, conceptions and practices of classroom-based writing assessment in Hong Kong. *System*, *81*(1), 78-89.

Li, Z., Yan, Z., Chan, K. K. Y., Zhan, Y., & Guo, W. Y. (2023). The role of a professional development program in improving primary teachers' formative assessment literacy. *Teacher Development*, *27*(4), 447-467.

Lu, X., & Kaiser, G. (2022a). Creativity in students' modelling competencies: Conceptualisation and measurement. *Educational Studies in Mathematics*, *109*(2), 287-311.

Lu, X., & Kaiser, G. (2022b). Can mathematical modelling work as a creativity-demanding activity? An empirical study in China. *ZDM: Mathematics Education*, *54*(1), 67-81.

Marwa, N. W. S., Pitria, P. R., & Madani, F. (2024). Development of authentic assessment of 21st-century skills in Kurikulum Merdeka. *Inovasi Kurikulum, 21*(2), 635-646

Nasir, N., Adnan, M., Rajoo, M., Ismail, A. O., & Hidayat, R. (2024). Development and effectiveness of digital classroom assessment document for form one mathematics in secondary school. *International Electronic Journal of Mathematics Education, 19*(3), 1-14.

Nguyen, A. T. T., & Tran, D. (2024). Quantitative reasoning as a lens to examine changes in modelling competencies of secondary preservice teachers. *Mathematics Education Research Journal, 1*(1), 1-28.

Nieminen, J. H., Asikainen, H., & Rämö, J. (2021). Promoting deep approach to learning and self-efficacy by changing the purpose of self-assessment: A comparison of summative and formative models. *Studies in Higher Education*, *46*(7), 1296-1311.

Nieminen, J. H., & Yang, L. (2024). Assessment as a matter of being and becoming: Theorising student formation in assessment. *Studies in Higher Education*, *49*(6), 1028-1041.

Oo, C. Z., Alonzo, D., Asih, R., Pelobillo, G., Lim, R., San, N. M. H., & O'Neill, S. (2024). Implementing school-based assessment reforms to enhance student learning: A systematic review. *Educational Assessment, Evaluation and Accountability*, *36*(1), 7-30.

Riyanto, B. (2022). Kepraktisansoal pemodelan matematika menggunakan konteks biaya parker. *Jurnal Santiaji Pendidikan*, 12(1), 53-65.

Riyanto, B. (2021). Developing mathematical modeling tasks using parking fee for learning mathematics. *Journal of Mathematics and Mathematics Education, 11*(2), 40-49.

https://doi.org/10.17509/jik.v21i3.72173

Riyanto, B., Zulkardi, Putri, R. I. I., & Darmawijoyo. (2019). Senior high school mathematics learning through mathematics modeling approach. *Journal on Mathematics Education*, *10*(3), 425-444.

Saligumba, I. B., & Segumpan, L. (2019). Mathematics performance and self-efficacy of grade 9 students in a differentiated assessments. *International Journal of English and Education, 8*(1), 477-490.

Sandal, A. K., and Sperle, A. K. (2024). Students' perspective on feedback in mathematics in high school. *Educational Assessment & Evaluation, 11*(1), 1-14.

Skulmowski, A. (2023). The cognitive architecture of digital externalization. *Educational Psychology Review*, *35*(4), 101-115.

Syaifuddin, M. (2019). The effect of students' perception on classroom assessment to students' attitudes. *Journal of Physics: Conference Series*, *1280*(4), 1-9.

Thaariq, Z. Z. A., Yulianto, M. F., & Nurdiyanto, R. (2023). Construction of an Adaptive Blended Curriculum (ABC) model in implementing local content curriculum. *Inovasi Kurikulum, 20*(2), 177-192.

Tsai, Y. C. (2024). Empowering students through active learning in educational big data analytics. *Smart Learning Environments, 11*(14), 1-21.

Tullis, J. G., and Goldstone, R. L. (2020). Why does peer instruction benefit student learning?. *Cognitive Research: Principles and Implications, 5*(15), 1-12.

van Schijndel, T. J., Jansen, B. R., & Raijmakers, M. E. (2018). Do individual differences in children's curiosity relate to their inquiry-based learning?. *International Journal of Science Education*, *40*(9), 996-1015.

Wong, H. M., Kwek, D., & Tan, K. (2020). Changing assessments and the examination culture in Singapore: A review and analysis of Singapore's assessment policies. *Asia Pacific Journal of Education*, 40(4), 433-457.

Wylie, E. C. (2020). Observing formative assessment practice: Learning lessons through validation. *Educational Assessment, 25*(4), 251-258.

Yan Z., Li, Z., Panadero, E., Yang, M., Yang, L., & Lao, H. (2021). A systematic review on factors influencing teachers' intentions and implementations regarding formative assessment. *Assessment in Education: Principles, Policy & Practice, 28*(3), 228-260.

Yan, Z., & Brown, G. T. (2021). Assessment for learning in the Hong Kong assessment reform: A case of policy borrowing. *Journal of Education for Teaching, 47*(2), 293-295.

Yan, Z., & Pastore, S. (2022). Are teachers literate in formative assessment? The development and validation of the teacher formative assessment literacy scale. *Studies in Educational Evaluation, 74*(1), 1-43.

Zhao, X., Van den Heuvel-Panhuizen, M., & Veldhuis, M. (2018). Chinese primary school mathematics teachers' assessment profiles: Findings from a large-scale questionnaire survey. *International Journal of Science and Mathematics Education, 16*(7), 1387-1407.

Zulkardi, Meryansumayeka, Putri, R.I.I., Alwi, Z., Nusantara, D.S., Ambarita, S.M., Maharani, Y., & Puspitasari, L. (2020). How Students Work with PISA-like mathematical tasks using COVID-19 context. *Journal on Mathematics Education, 11*(3), 405-416.

https://doi.org/10.17509/jik.v21i3.72173