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Practicality of Student-Centered Assessment/Learning using Mathematics Modeling Process Worksheets to Improve the Quality of Education

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ABSTRACT

It is necessary to consider reforms to improve the quality of education through assessment/learning. The problem formulation of this research is how to design student-centered assessment/learning using practical mathematical modeling process worksheets to improve the quality of education? This research uses a development research approach developed by Akker, Gravemeijer, McKenney and Nieveen. This development research consists of 3 steps, namely analysis, design and evaluation. In the analysis step, student analysis, curriculum, mathematical modeling and real world problems are implemented. Second step, 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 test. Data were analyzed using descriptive analysis methods: (1) walk through, analysis based on solutions and student comments in small groups to obtain student-centered assessment/learning using mathematical modeling process worksheets using the best practical transportation context to improve the quality of education; (2) analyzing the results of the review of small group results. Based on the results of the small group worksheet, the mathematical modeling process is practical for improving the quality of education. Students commented that this mathematical modeling process worksheet was interesting, confusing but challenging and had never been found in their classrooms. Students can solve problems on process worksheets even though the mathematization process has not yet appeared, because students only solve them using informal methods. So, this is a golden opportunity to implement in order to improve the quality of education through assessment/learning. So, a practical mathematical modeling process worksheet is obtained to implement student-centered assessment/learning in order to improve the quality of education.

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Keywords:
Practicality; student-centered assessment/learning; process worksheets; mathematical modeling; quality of education

INTRODUCTION

Students cannot escape from assessment if they want quality (Boud & Hawke, 2003). Bearman et al. (2020) stated that traditional assessment designs, which tend to emphasize knowledge and memory, are no longer suited to the dynamic and networked digital world. Although it could be argued that the primary purpose of educational assessment is to support learning, in practice, assessment is often more focused on qualifications and reporting achievement (Timmis et al., 2016).

Poor assessment practices are often held responsible for low instructional and learning quality (Dochy et al., 1996). Educational assessment researchers argue that, taken together, advances in cognitive science and measurement can provide a powerful basis for overhauling educational assessment (Pellegrino et al., 1999). Boud (2006) stated that although students may be able to escape poor teaching, they also cannot escape poor

assessment. Improvement in learning is still not a priority in teachers' assessment practices because they tend to use assessments only for grading purposes (McNair et al., 2003).

Although the use of phrases such as student-centered learning relates to the teaching and learning process, it can be argued that differentiated approaches to instruction and assessment constitute the truest framework for student-centered learning (Varsavsky & Rayner, 2013). Learner-centeredness originates from a constructivist learning approach (Zhang & Lin, 2018) and is characterized by a supportive learning environment in which students are free to make mistakes and learn from each other (Cornelius-White, 2007), and have greater control over direction. and their learning rate (Killen & O'Toole, 2022).

It is generally believed and has been proven that assessment has an important impact on instruction and learning (Dochy et al., 1996). Currently, the recommendation is to make assessment more integrated with instruction (Shepard, 2001). Assessment/instruction integration makes tests part of the environment itself and part of the structure of student learning (Brookhart & Helena, 2003). While instruction gets all the attention in the literature on differentiation, an equally important aspect of teaching and learning, assessment is largely overlooked (Noman & Kaur, 2014). Ihalon (2022) recommends that the use of learning activity sheets enhanced with differentiated assessment techniques be used in the classroom to improve student academic performance. Yet in all the efforts to link assessment and instruction, the instructional questions and the tests remain distinct; Instructional design and test design are independent activities (Snow & Mandinach, 1991). No one yet has principles for building an integrated instruction - assessment system that is valid and useful for teachers (Snow & Mandinach, 1991). Snow & Mandinach (1991) argue that we can envision a unification of instructional design and assessment in which learning and assessment originate from the same questions and activities, but this appears to require a coordinated theory of learning progression and diagnostic assessment for adaptive teaching in the instructional domain, however such a theory is not currently available.

Mathematical modeling questions really support innovative assessments because students can be given wider opportunities to express their ideas in the mathematics learning process (Riyanto, 2023). In mathematics lessons, problems without real world references are often worked on (Wijaya et al., 2015; Heinle et al., 2022). Application of knowledge rather than recall is considered more important in an era where information is easily available (Bearman et al., 2020). Dochy et al. (1996) concluded that pressing questions for future research should be directed at whether assessment contributes to instructional attractiveness for students, and whether its predicted impact will improve educational quality and output.

Indonesian students have difficulty converting real world problems into mathematical problem models (Wijaya, 2015). Also, the results of the Program for International Student Assessment in 2022, and Indonesia is ranked 68th with a mathematics score of 379 which is still not encouraging (Media Indonesia, 2024). Riyanto (2023) reports that students cannot produce mathematical models by making assumptions. This shows that Indonesian students are weak in transferable skills. One solution to this problem is the implementation of student-centered assessment/learning using mathematical modeling process worksheets to improve the quality of education.

We never know when initial efforts will be made—the discovery of the integration of assessment and instruction has proceeded favorably enough to establish a research agenda (Snow & Mandinach, 1991). A long-term view of research needs can help focus short-term decisions on design and development, at least prototypes (Snow & Mandinach, 1991). Dochy (1992) developed an independent learning model where informal assessment, formal assessment and learning are integrated. Local research shows that efforts to improve learning achievement rarely use assessment as a means of raising standards (World Bank,

2008). Marzano (2010) student-centered assessment is the most underutilized, that is, as the name suggests, students generate ideas about how they will demonstrate their current status on a particular topic, such as a student may propose that he or she design and explain a leadership model to demonstrate his or her knowledge of the topic. . Education has not developed other ways to assess student growth at the national level, therefore, each region has the goal of making its students perform well in end-of-year standardized tests or summative assessments (Galamison, 2014). The issue of teacher effectiveness as a locomotive for reforming assessment practices and teachers' thinking about assessment is still under-researched in Indonesia (Sundayana, 2015). Although much research focuses on the importance of curriculum and instruction, assessment is the missing piece that completes the effective instructional cycle (Gareis & Grant, 2015). There is little evidence regarding how teachers in resource-limited classrooms can integrate assessment for learning into their lessons and how assessment for learning contributes to student achievement in such contexts (Kyaruzi et al., 2019). At the Indonesian level, Arrafii (2020) believes that considering the testing system that already exists in Indonesia, the adoption and development of a new assessment system by teachers could lead to resistance. Developing effective and meaningful assessments for 21st century skills will be a priority in the coming years (Kaushik, 2021). Most importantly, the curriculum lacks practical examples showing how assessment reform can be implemented in the classroom (Tarmo, 2021). Classroom assessment practices and vocational skills development are suggested for research and can be expanded in application (Yusop et al., 2023). In line with the learner-centered nature of formative assessment, the research of Parmigiani et al. (2024) create and investigate conditions for building higher education learning environments where students can experience multiple types of assessment and can reflect on and improve their own learning processes and competency development.

The formulation of the research problem is how do the characteristics of assessment/learning focus students using mathematical modeling process worksheets in the context of transportation selection to improve the quality of education? The aim of this research is to produce student focused assessment/learning using mathematical modeling process worksheets in the context of transportation selection to improve the quality of education. The research target is to improve the quality of education through assessment/learning through process worksheets. The result to be achieved is the production of student focused assessment/learning in the form of practical mathematical modeling process worksheet instructional to improve the quality of education. The framework of this research is shown in Figure 1.

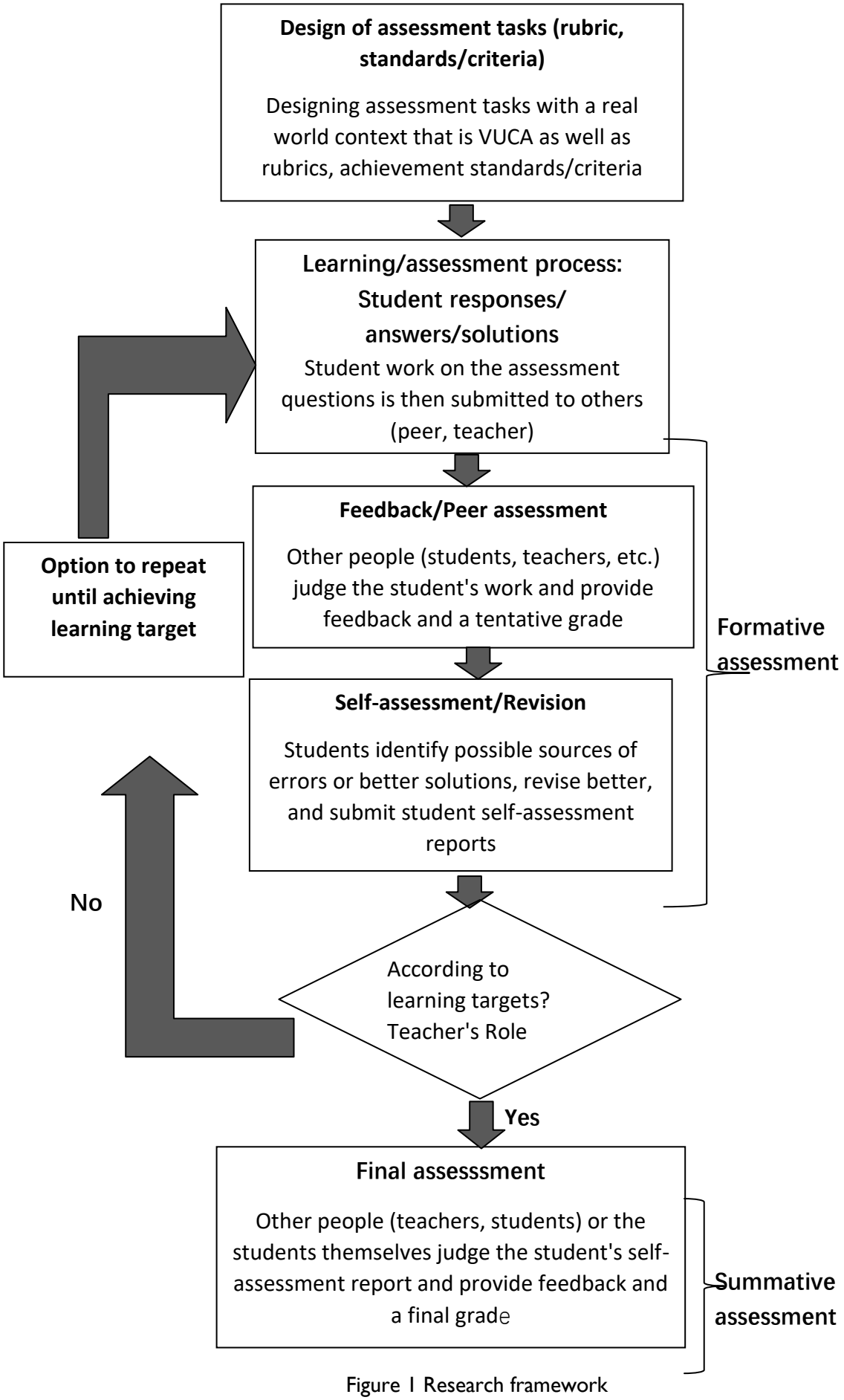


Figure 1 Research framework

METHOD

The research method is design research type development studies developed by Akker, Gravemeijer, McKenney and Nieveen. This research consists of three stages, namely analysis, design and evaluation (Tessmer, 1993, Zulkardi, 2006). The analysis phase carried out analysis of assessment, instruction, learning, students, curriculum, real world problems, and mathematical modeling. Design, design and product stages of the mathematical modeling process worksheet. The evaluation stage uses a formative evaluation design (Figure 2) consisting of self-evaluation, one-to-one, expert review, small group, and field tests (Tessmer, 1993, Zulkardi, 2006).

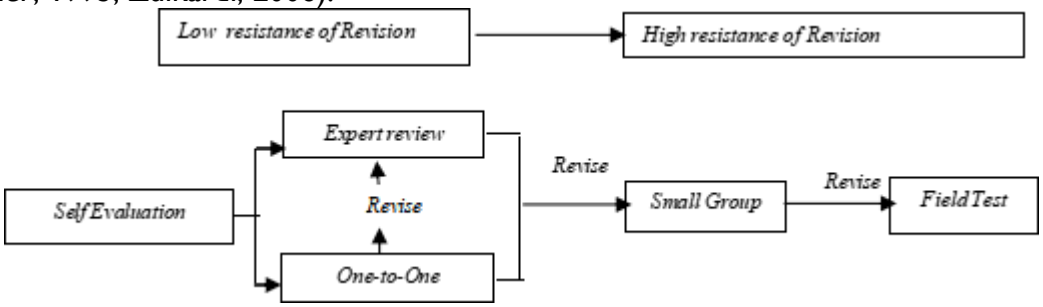
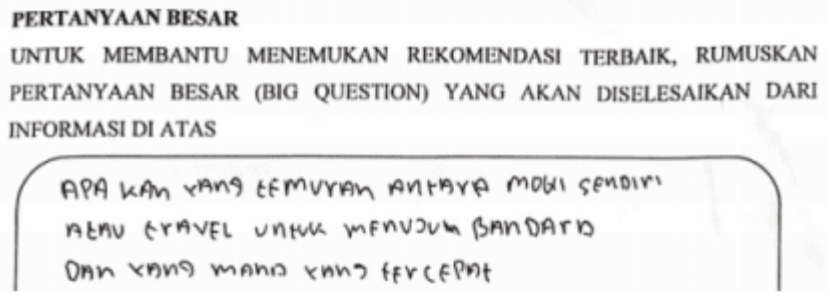


Figure 2 Formative evaluation design (Tessmer, 1993, Zulkardi, 2006)

The data collection technique in this research is Walk through, this is based on student solutions and comments to obtain practical mathematical modeling questions using the context of parking costs. The data analysis technique is analysis of walk through sheets based on solutions and comments from students in small groups to obtain instructions in the form of mathematical modeling process worksheets using practical transportation selection contexts for student-centered assessment/learning in order to improve the quality of education. This research only focuses on small groups in the formative evaluation phase. The subjects of this research were 3 children in class X Multimedia at SMKN 3 Kayuagung.

RESULTS AND DISCUSSION

The research only examines the results of a small group conducted Friday, March 29 2024 with the subject of X Multimedia students at SMKN 3 Kayuagung. The researcher asked 3 class X Multimedia students at SMKN 3 Kayuagung to complete a mathematical modeling process worksheet using the context of transportation selection to see its practicality. Figure 3 is the student's answer to the stage of simplifying the problem.


PERTANYAAN BESAR

UNTUK MEMBANTU MENEMUKAN REKOMENDASI TERBAIK, RUMUSKAN PERTANYAAN BESAR (BIG QUESTION) YANG AKAN DISELESAIKAN DARI INFORMASI DI ATAS

APA KAH YANG EFMURAH ANTARA MOBI SENDIRI ATAU TRAVEL UNTUK MENUJUK BANDARA DAN YANG MANA YANG TERCEPAT

Figure 3 problem formulation by small group students

This shows that students can formulate the problem to be solved, namely by asking the question of what is the cheapest and fastest between using a private car or using a travel/taxi to get to the airport. They assume to look for the cheapest and fastest costs.

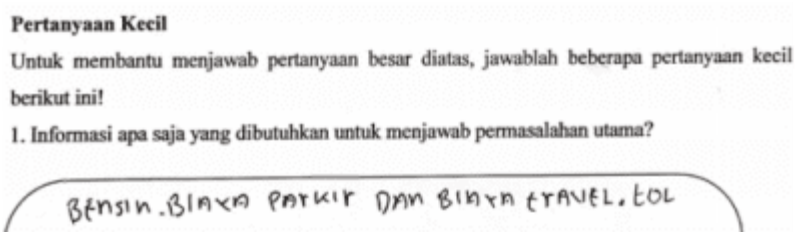


Figure 4 Determining important information by small group students

Figure 4 shows that the students' answers only show petrol consumption, parking costs, travel costs and toll costs, but do not mention complete and specific details such as distance, the relationship between petrol consumption and distance, the relationship between parking costs and parking time. This supports the research of Riyanto et al. (2017) that students cannot make assumptions in the modeling process which serves to simplify the problem because modeling questions are new for students in Indonesia. However, this shows that students already have a basis for determining mathematical models, even though they are not yet detailed and complete.

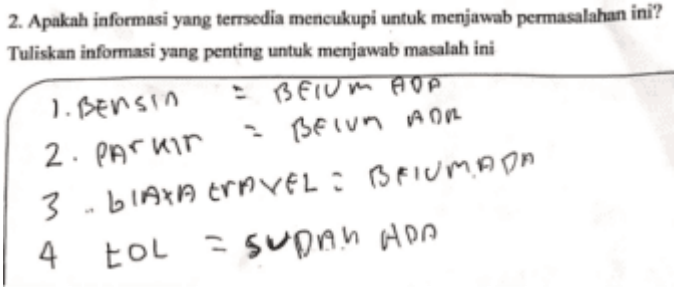


Figure 5 Determining the availability of information by small group students

Figure 5 shows that students are able to determine which information is available and which is not yet available, but not yet in complete and detailed terms. This is because mathematical modeling has not existed in schools so far. So, revision is needed, namely by providing a hint/prompt/scaffold regarding the relationship between the amount of fuel consumption and distance traveled, as well as parking time and parking costs, namely providing an example of the use of data on the relationship between these two quantities. This is in accordance with Riyanto (2024) that students can determine problems and have contributions in the form of ideas in providing recommendations, but cannot make explicit assumptions, are not yet able to do mathematics, where students can do mathematics informally.

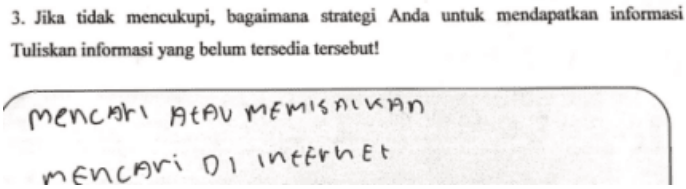


Figure 6 Determining information that is not yet available to small group students

Figure 6 also indicates that students are not yet able to make assumptions with estimates so as to produce better mathematical models. This is in accordance with research (Riyanto et al., 2018; 2019) which reports that students cannot make assumptions and cannot validate the results of mathematical modeling. Students only mention searching or making examples or searching on the internet without mentioning more effective strategies. However, it has the potential to develop mathematical modeling skills.

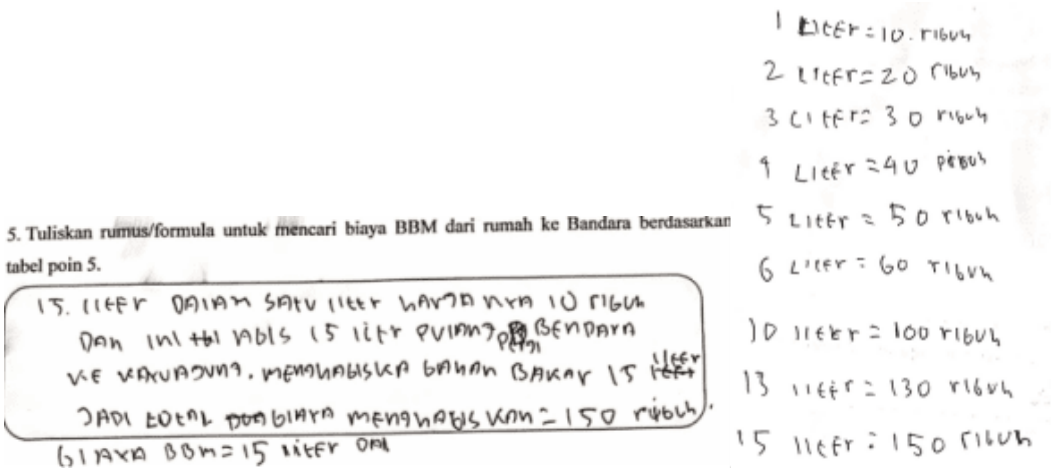


Figure 7 Formula for finding fuel costs and the process of finding patterns by small group students

Figure 7 shows that students have not yet come up with mathematization but students only do it informally. So, this is very important to develop in the future. This result is in accordance with Riyanto (2023) that students cannot produce mathematical models by making assumptions.

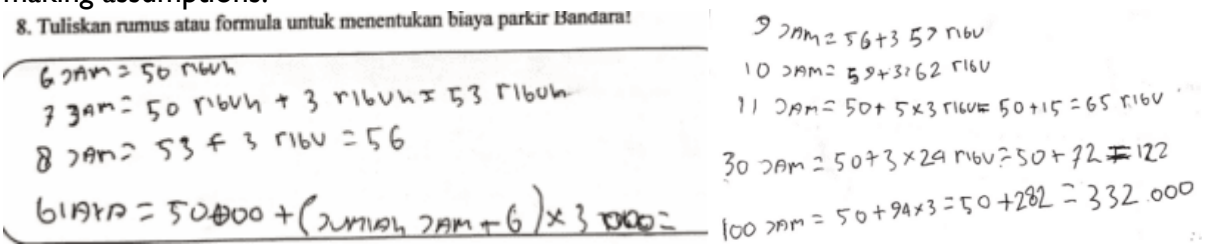


Figure 8 Parking cost formula and process of finding patterns by small group students

Figure 8 explains that students can determine a formula that states the relationship between parking time and costs. But this is still an informal stage or does not yet show the relationship between the two variables. This indicates that this student is still weak in multiplication skills. It only increases every time the time increases by 1 hour. Thus, mathematical modeling is a good tool for diagnostic assessment.

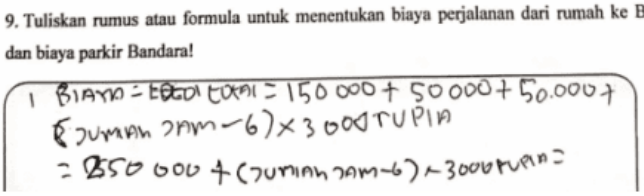


Figure 9 Formula for travel costs by small group students

Figure 9 explains that students can provide conclusions about travel costs, namely fuel, tolls and parking costs informally.

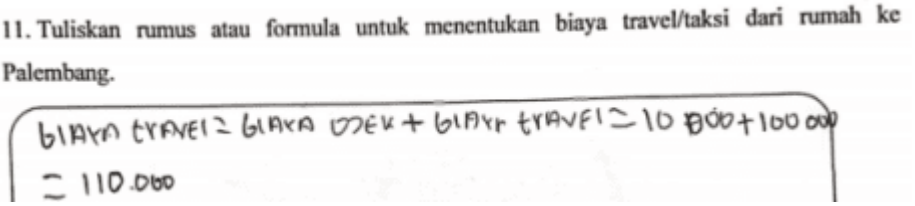
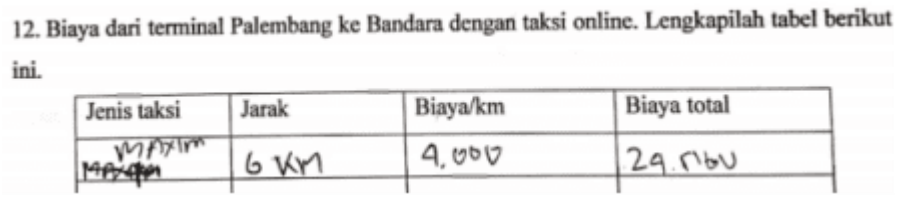


Figure 10 Taxi costs by small group students

Figure 10 implies that students only determine the costs of motorbike taxis and travel informally, not mathematically. The student has set travel and motorbike taxi costs

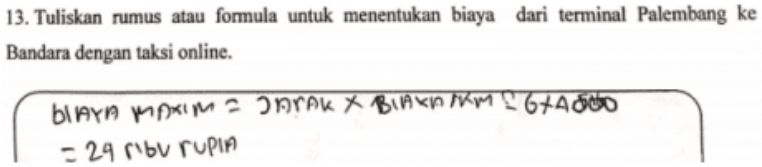
constantly, namely 110,000 because it is based on the experience he has had so far.


12. Biaya dari terminal Palembang ke Bandara dengan taksi online. Lengkapilah tabel berikut ini.

Jenis taksi	Jarak	Biaya/km	Biaya total
Maxim	6 KM	4.000	24 ribu

Figure 11 Online taxi costs by small group students

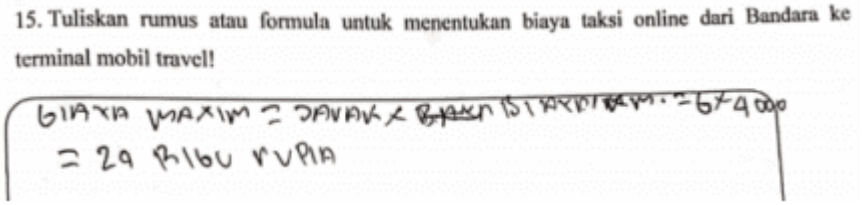
Figure 11 illustrates that students can determine the cost of an online taxi by searching on the internet. Here students do not do mathematics, namely the relationship between distance traveled and cost per kilometer. This is in accordance with previous research, mathematization is difficult (Gould & Wasserman, 2014; Haines & Crouch, 2005; Riyanto, 2020).


13. Tuliskan rumus atau formula untuk menentukan biaya dari terminal Palembang ke Bandara dengan taksi online.

BIAYA MAXIM = JARAK X BIAYA/KM = 6X4000
= 24 RIBU RUPIA

Figure 12 Online taxi costs by small group students

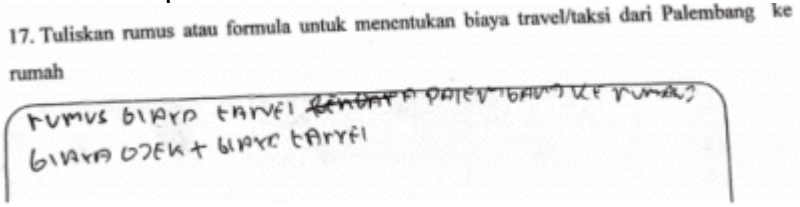
Students only use informal methods in determining online taxi costs shown in Figure 12.


15. Tuliskan rumus atau formula untuk menentukan biaya taksi online dari Bandara ke terminal mobil travel!

BIAYA MAXIM = JARAK X BIAYA/KM = 6X4000
= 24 RIBU RUPIA

Figure 13 Online taxi costs by small group students

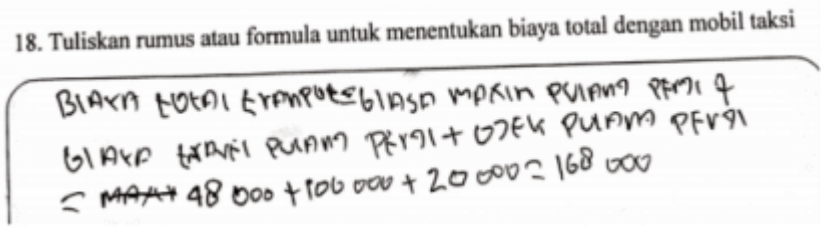
Students do not write explicit formulas or do not do the math shown in Figure 13.


17. Tuliskan rumus atau formula untuk menentukan biaya travel/taksi dari Palembang ke rumah

RUMUS BIAYA TRAVEL
BIAYA OJEK + BIAYA TRAVEL

Figure 14 Taxi cost formula by small group students

Students also only determine taxi costs informally given by figure 14.


18. Tuliskan rumus atau formula untuk menentukan biaya total dengan mobil taksi

BIAYA TOTAL ANTARA BIAYA MAXIM PULANG PERGI &
BIAYA TRAVEL PULANG PERGI + OJEK PULANG PERGI
= 48 000 + 100 000 + 20 000 = 168 000

Figure 15 Total cost formula for taxis by small group students

Figure 15 explains that students also determine the total cost of a taxi informally, so students do not validate the results.

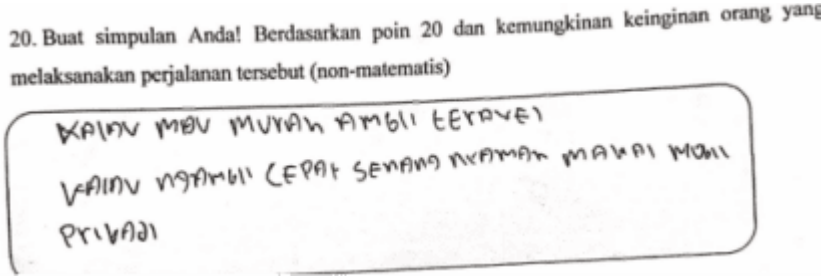


Figure 16 Conclusions by small group students

Figure 16 shows that students concluded that if they wanted to be cheap, take the travel option, if they wanted to be fast and comfortable, they would like to use a private car.

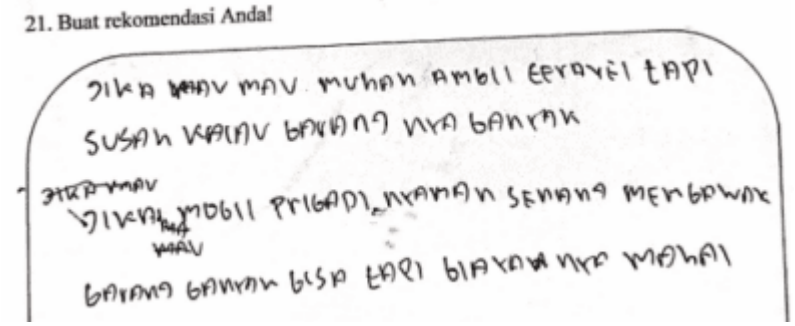


Figure 17 Recommendations by small group students

Figure 17 shows that students can provide recommendations according to the questions they asked themselves at the beginning. Furthermore, it can be seen from students' comments that students are happy, interesting, easy but need to think. This is in accordance with the results of previous research that working on modeling questions is seen as a difficult activity for students because of the cognitive complexity of the questions (Blum, 2011, Ferri, 2021). So, this process worksheet is promising for the future for the quality of education. Figure 18 shows student comments.

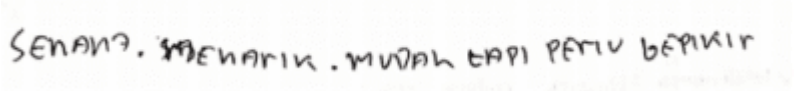


Figure 18 Comments by small group students

Based on the results of this research, it shows that students have the potential to learn mathematics formally because students are able to develop their own mathematical abilities informally. If this continues to be developed, it will lead to improving formal mathematics abilities through continuous revision via feedback from other people (teachers, peers, etc.) using formative assessments, thereby developing children's cognitive and affective abilities.

The growing importance of high stakes assessments in many countries in recent years as a policy tool to encourage greater competition and accountability between schools and across educational systems as a whole, has increased the focus on periodic and summative assessments of student performance in terms of overall grades and percentages (Timmis et al., 2016). Assessment is an important and complex topic for research (Czerniewicz & Cronin, 2023). High-stakes, large-scale exams have a long-term impact on students' life chances because the results are used to select students for high-value places in further education and the world of work (Tarmo, 2021).

Key players who provide great support in the learning process such as oneself, peers, and other personnel who are not teachers are very marginalized in the assessment process

and are often excluded from providing feedback to students (Atibuni & Olema, 2017). Current assessment practices are not good at encouraging learning for short-term goals only compounding the problem (Boud & Hawke (2003).

The need to identify new skill sets for twenty-first century competencies requires the nature of assessment to change (Shute & Becker, 2010). French et al. (2023) note that in the scientific literature on assessment in higher education, questions relating to the pedagogical value of final exams arise repeatedly. In a world increasingly transformed by technology in the way people communicate, conduct business and live daily life, schools, colleges and universities have been slow to adapt to these changes, particularly in assessment methods and practices (Shute et al., 2010).

As the culture shifts from tests to assessments, we must also try to change the culture in students (Dochy, 2001). When formative assessment is seamlessly integrated into instruction, it does not require additional costs or instructional time (Shepard et al., 2018). Classroom assessment practices can be expanded in scope because they are seen as holistic evaluations that include summative and formative tests designed to measure and develop students' knowledge, abilities and positive values (Popham, 2017).

Traditional thinking claims that formative and summative assessments are distinct, implying that formative assessments support student learning and summative assessments measure ongoing student learning (Hattingh & Dison, 2020). If we want our college graduates to have the 21st century skills outlined above, assessment must focus on higher-order types of outcomes (Reeves, 2006). Grading student work is an exercise in decision making (often in great detail, and sometimes with great pain), but has received little research attention (Yorke, 2011). Seeing assessment examples and getting various opportunities to try new assessment strategies is necessary (East, 2015).

According to Kanjee & Sayed (2013) that both formative and summative (continuous assessment) are important for assessing holistically and both are seen as beneficial when used simultaneously (unison). The shift to high-stakes testing is linked to broader macro-level processes, including the internationalization of higher education which has brought a global dimension to the curriculum which has had an impact on assessment design, and digitalization which has opened up new possibilities for more diversified and creative assessment methods that can be implemented on a large scale (French et al., 2023).

If the purpose of assessment is to draw conclusions about whether students can solve problems using the knowledge and experiences they have learned in the classroom, a testing-on-demand situation in which each student receives a test without considering his or her personal instructional history may be unfair (NRC, 2001). It is recognized that the increasing complexity of learning required by 21st century graduates cannot be adequately assessed through examinations (OECD, 2014). Assessment is viewed by most people almost exclusively as an act of measurement that occurs after learning is completed, rather than as a fundamental part of the teaching and learning process itself (Boud, 2006). Assessment is a senior partner in learning and teaching, if you make an assessment error, then everything else collapses (Biggs & Tang, 2011). Teaching and assessment have become separated, leaving teachers unable to develop the assessment skills they need to truly improve learning (Stiggins, 2014). What we need is a shift from controlling quality in learning to quality assurance (Leahy et al., 2005). Nieminen et al. (2019) note that there is a large body of research on whether it is possible to promote deep learning approaches, where often, assessment is seen as the answer.

Assessment is both a product and a process (future oriented) (Lund, 2008). Sandal (2023) concludes that the regulations for formative assessment are complex and require thorough consideration by teachers and schools when implemented, so it can be said that vocational education in teacher schools needs to develop perceptions and concepts of

formative assessment that are adapted to the vocational learning community and encourage appropriate learning assessment. embedded in vocational learning and teaching practices. Bearman et al. (2020) argue that assessments should help students navigate the dynamic knowledge and truth structures that are characteristic of the digital world. Further interpretation of the coded data revealed two overarching themes, namely 1) responsibility for the questions and for colleagues and 2) learning through assessment (Stančić, 2020).

Recent developments in today's society have changed the goal of knowledgeable students in certain domains of basic knowledge retention, i.e. the emphasis is on producing highly knowledgeable individuals, but also emphasizes problem solving skills, professional skills and authentic learning, i.e. learning in real life contexts (Dochy, 2001). On many occasions, students are encouraged to fear the 'failure' side of summative assessment and end up engaging in actions such as examination malpractice that increase success in test scores but damage learning (Atibuni & Olema, 2017). Modern learning approaches place student achievement at the center of improvement and quality assurance (El-Maaddawy, 2017). There is a clear need for deeper teacher engagement with assessment theories and more intentional and strategic approaches to assessment in Schools to increase student success across the assessment landscape (Hattingh & Dison, 2019). The implementation of school-based assessment reforms focused on supporting student learning presents significant tensions in test-driven school cultures (Oo et al., 2024). Teachers accustomed to exams and tests may refuse to accept informal assessments such as self- and peer-assessment and feedback, which may interfere with the successful implementation of reforms (Yu, 2015). Although traditional thinking believes that formative and summative assessments are very different, implying that formative assessments support student learning whereas summative assessments do not, there is an argument that in some cases formative and summative assessments can be interrelated (Sambell et al., 2013). This linkage is carried out, namely that informal questions (traditionally seen as formative) can be summated to provide input into the final result (summative) and the results of summative questions can be formative by providing feedback on learning (Fry et al., 1999).

Assessment for learning is aimed at the quality of the learning process, not at outcomes such as grades (Van der Kleij et al., 2015). This goal stimulates a classroom culture that is learning-oriented rather than results-oriented and rejects the traditionally dominant psychometric assessment paradigm (Van der Kleij et al., 2015). The development of formative assessment has proven to be not easy (Crossouard, 2011). The difficulty of implementing formative assessments can also give rise to instrumentalism and dependence on tutors, rather than student autonomy (Torrance, 2007).

Formative assessment allows teachers to account for individual student progress, structure responsive instruction, and develop student-centered science learning environments (Bell & Cowie, 2001). Although there are differences of opinion regarding the precise definition of student-centered learning, the core assumption is active involvement in learning and learners' responsibility for the management of learning (Lea et al., 2003). Formative assessment will remove barriers between curriculum, instruction, and assessment if teachers are supported and formative assessment is utilized effectively in the classroom (Xie & Cui, 2021). During a vocational skills demonstration, students' comprehensive mastery of the work process and the task itself becomes the focus of assessment (Mulder & Winterton, 2017). Teachers who carry out assessments must have a broad and deep understanding of assessment methods, criteria, and expected results (Glogger-Frey et al., 2018).

The assessment process consists of four steps: generating and collecting evidence of achievement, evaluating the evidence against results, recording evaluation findings, and using the information to foster student development and improve the teaching and learning

process (Nkalane, 2018). In turn, this implies that students need to be prepared to learn, unlearn, and relearn as they progress through the various stages of lifelong learning (Kaushik, 2021). Assessments aimed at evaluating transversal skills are not easily adapted to educational systems that primarily use learning assessments for summative or certification purposes (Care et al., 2017). Sandal (2023) concluded that the complexity of formative assessment and the variety of definitions, the effort and time required to implement it in the classroom, and the uncertainty related to administering formative and summative forms of assessment affect fidelity in research in formative assessment (Anderson & Palm, 2018), thus, assessment summative is used for formative purposes.

Instruction and assessment are viewed as unified activities and interventions mediating the learner's journey in the zone of proximal development (Lund, 2008). The fact that differential delivery of instructional guidance can be used to fully explain problem-solving skills emphasizes the importance of long-term memory for cognition (Kirschner & Sweller, 2006). The goal of all instruction is to modify long-term memory (Kirschner & Sweller, 2006). If nothing changes in long-term memory, nothing is learned (Kirschner & Sweller, 2006). Any instructional recommendation that does not or cannot determine what has been changed in long-term memory, or that does not improve the efficiency of storing relevant information or retrieving it from long-term memory, is likely to be ineffective (Kirschner & Sweller, 2006). Any instructional recommendation that does not or cannot determine what has been changed in long-term memory, or that does not improve the efficiency of storing relevant information or retrieving it from long-term memory, is likely to be ineffective (Kirschner & Sweller, 2006). Formative assessment is an assessment technique that originates from the constructivist learning paradigm (Sanchez-Lopez et al., 2023).

Learning question design is not an easy task (Reeves, 2006). If we establish appropriate assessment processes, effective teaching and learning will occur (Curtis, 2010). Outcomes-based assessment strategies that emphasize how much students learn rather than how they learn will not be appropriate for assessing instruction that relies on students interacting with each other and actively engaging in the learning process (Sanchez-Lopez et al., 2023). In the context of how students learn, a formative assessment approach based on the principle of assessing learning is important in improving the quality of education (Ghahari & Sedaghat, 2018). The change in focus was accompanied by the assumption held by many leading educators and discipline specialists that knowledge can best be learned or only learned through experience based primarily on disciplinary procedures, leading to a commitment by educators to extensive practical work or projects, and a rejection of instruction based on the facts, laws, principles and theories that make up the content of the discipline are accompanied by the use of discovery and inquiry methods of instruction, thus, the addition of a stronger emphasis on the practical application of inquiry and problem solving skills appears to be very positive (Kirschner & Sweller, 2006). Mayer (2004) concluded that the debate about inquiry has been repeated many times in education but each time, the evidence supports the guided learning approach.

For elementary school students, mathematical modeling is different from traditional school mathematics which emphasizes speed and accuracy (Wang et al., 2023). Mathematical modeling is more challenging and motivating and encourages students to generate their own mathematical ideas (English, 2021). Classroom observation studies show that during actual teaching, most teachers ask closed-ended questions and prefer single answers, which are often known in advance (Tarmo, 2021). Experts reject what is called a 'parrot-like' approach to teaching, or rote learning, and instead advocate an approach that will pay attention to the whole child, namely the child's intellectual, physical and emotional growth through experience, child-centred learning and play (Reese , 2001). Most educational systems throughout history and throughout the world include the acquisition of certain knowledge

as their ultimate goal (Glăveanu, 2022). Conventional student learning measurements need to be eliminated and replaced with authentic assessments that reflect real work situations (Biggs & Duncan, 2009). Shute & Becker (2010) quote Dewey's (1916) statement that knowledge is no longer a solid, immovable object; it has been diluted, that is, actively moving in all currents of society itself, which was almost 100 years ago, is very relevant today. Creativity can feel uncomfortable to engage in, not only because of our human tendency to want to stay in our comfort zone of experience; but also, the education system ignores creativity due to the uncertainty that exists in creative spaces and actions, which are difficult to standardize, measure and evaluate (Henriksen et al., 2022). Educational systems are often built on artificial separation between subjects, with a focus on developing abstract disciplinary knowledge divorced from real-world complexities (Henriksen et al., 2022). Traditionally, learning is associated with the acquisition of knowledge, while creativity, at least in its initial stages, is associated with the experience of uncertainty (Glăveanu, 2022). We need to learn something new and create things or procedures that we have never used before (Glăveanu, 2022). In fact, the characteristics of creative learning remain non-linear and open-ended (Glăveanu & Beghetto, 2020).

In a highly competitive world, it would be foolish to suggest that any improvement in standardized testing will resolve the paradox between weighing quality and equity in education (Palincsar & Winn, 1990). Kellaghan & Greaney (2001) argue that when considering reform improving the quality of education through assessment. Quality refers to the standards that must be met to achieve certain goals for customer satisfaction (Ellis, 1995). Society should be protected from graduates who cannot achieve the expected standards (Sullivan et al., 2007). The results are promising for instructional assessment and will have an impact on improving educational quality and outcomes (Moerkerke, 1996). In improving the quality of education, many countries are increasingly focusing on understanding the complex interactions that occur at school, classroom, and community levels as key engines of quality and as a way to involve local actors to overcome weak links between policy and practice (Farrell, 2002). Of the factors that contribute to the quality of education at the local level, quality of teaching is recognized as key, a factor without which other quality inputs will not be successful (USAID, 2006).

One of the main indicators of educational quality is cognitive learning which is the main explicit goal of most educational systems, although there are differences of opinion regarding what is measured as cognitive learning and how to measure it (Logaw, 2017), meanwhile, social, creative and emotional development is rarely assessed significantly (UNESCO, 2014). Changes in educational practices that reflect trends in improving teaching and learning require thoughtful actions that develop and link learning, teaching, assessment, and curriculum (Barkley & Major, 2016). Assessment is considered central to changing educational practices (El-Maaddawy, 2017). Improved assessment practices are needed to improve the quality of learning (El-Maaddawy, 2017). Logaw (2017) concluded that one of the main characteristics of quality teaching is providing effective comments on student work. Quality teaching requires teachers to understand and plan wisely the five main elements of the classroom: learning environment, curriculum, assessment, instructional, and classroom leadership/management (Tomlinson et al., 2015). Assessment of students' learning in the classroom, carried out by their own teachers, deserves serious consideration in the context of improving the quality of education (Kellaghan & Greaney, 2001). Brookhart (2001) states that we do not neatly distinguish between formative and summative assessments, but use assessments in a variety of integrated ways, including some of which can be categorized as formative with summative hints and summative with composition/components/formative bits. Paradigm: Integration of formative and summative assessments for the same assessment is shown in Figure 19.

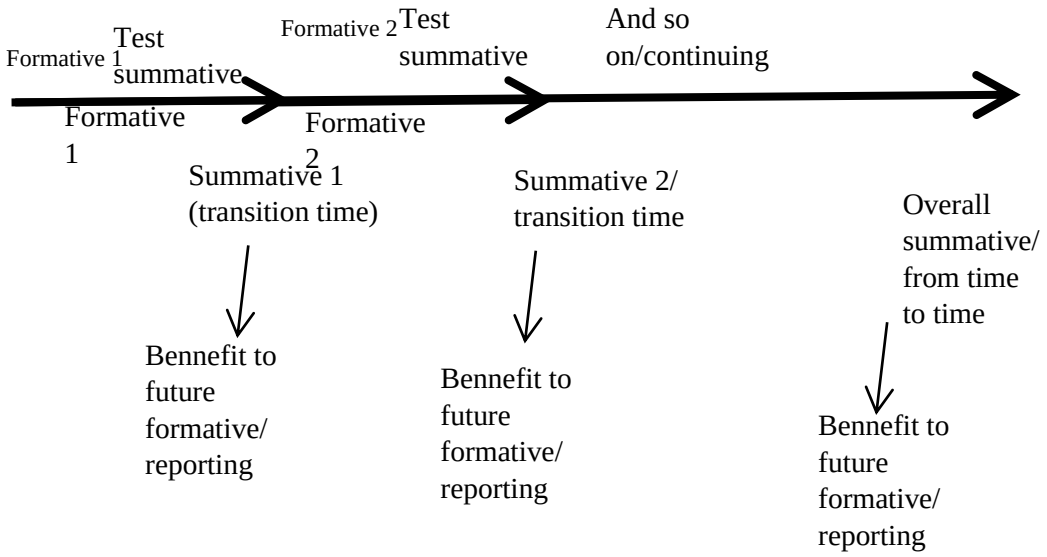


Figure 19 Unification of theory in assessment, instruction and learning (Riyanto, 2024)

CONCLUSION

This research has produced student-centered assessment/learning using mathematical modeling process worksheets as an instructional tool in the context of transportation selection to improve the quality of education.

Recommendations for policy making, namely to implement mathematical modeling process worksheets for mathematics learning and real world situation process worksheets (Volatility, Uncertainty, Complexity, Ambiguity) for other subjects in improving the quality of education. Policy makers, to adopt a policy of integrating assessment, instruction and learning as the implementation of student-centered pedagogy in order to improve the quality of education.

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