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Description of Students' Responses to a Creative Problem-Solving Model Incorporating the Ethnomathematics of the Troso Wofen Fabric Motif from Jepara

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Abstract

This study aims to describe the responses of seventh-grade students to the implementation of the Creative Problem Solving (CPS) learning model integrated with the ethnomathematics of troso woven fabric on the topic of quadrilaterals and triangles. A descriptive quantitative approach was employed. The subjects were 27 seventh-grade students at SMP Negeri 2 Welahan Jepara, selected using purposive sampling. The instrument was a student response questionnaire consisting of 16 items using a four-point Likert scale. The results showed that overall student responses were in the positive category, with a mean score of 3.19. The aspect of interest in the CPS model achieved the highest score (3.42) in the very positive category. The aspects of ease of understanding the material (3.15), active participation (3.02), benefits of the CPS model in problem-solving (3.09), and positive attitudes toward local culture (3.20) were all in the positive category. However, difficulties were found in students' independence in solving mathemacal word problems (lowest score 2.05). Overall, the CPS model integrated with Troso woven fabric ethnomathematics received positive responses and is feasible to implement, with the note that varied exercise problems and intensive assistance for students still experiencing difficulties are needed.

Keywords: Student Responses; Creative Problem Solving; ethnomathematics; Troso woven fabric; quadrilaterals and triangles

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INTRODUCTION

Mathematics education in junior high school continues to face various challenges. One of the main challenges is the low level of active student participation during the learning process. Many students tend to be passive, lack direct engagement in understanding concepts, and rely solely on memorizing formulas without fully grasping their meaning. This situation directly impacts suboptimal mathematics learning outcomes (Rusdiana, Hidayat, Dimpudus, & Ikmawati, 2025). To address this issue, innovative teaching approaches are needed that focus not only on outcomes but also on the process of how students learn in a conscious, meaningful, and enjoyable manner.

The Creative Problem Solving (CPS) learning model is a promising alternative for enhancing student engagement and critical thinking skills. CPS is a structured, multi-step method for solving problems that emphasizes creative idea generation and systematic solution implementation, and it has been widely applied across various disciplines to support mathematics learning (Treffinger, Isaksen, & Stead-Dorval, 2006; Isaksen & Treffinger, 2004; Puccio, Murdock, & Mance, 2011). The CPS model follows a systematic syntax: understanding the challenge, generating ideas, planning actions, and implementing solutions. Previous research indicates that implementing the CPS model in mathematics instruction significantly increases student engagement, with engagement scores reaching 85.00 in the first session (Rusdiana et al., 2025). Furthermore, the CPS model has also proven effective in improving students mathematical problem-solving skills and learning outcomes, with the experimental class achieving an average score of 78.79, while the control class scored only 40.46 (Rusdiana et al., 2025). These findings are consistent with broader evidence that the CPS model consistently enhances students creative thinking abilities across various educational levels and subjects, and contributes positively to students higher-order thinking skills in mathematics education (Munafiah, Ningsih, & Kusuma, 2019; Frontiersin, 2025). Thus, the CPS model has a strong empirical foundation for application in mathematics instruction, particularly in geometry.

However, the effectiveness of a learning model is not determined solely by the syntax used but also by the extent to which the model is accepted and positively received by students. Student response is a key indicator reflecting their engagement, interest, comfort, and perceptions of the learning process. Armia, Molle, and Tamalene (2021) found that students responses to the CPS learning model influence their mathematical problem-solving abilities. Other studies also report that student responses to the CPS model achieved an average percentage of 74.58% with a good rating (Hadi, 2023), and out of 13 response items, 11 were in the very good category and 2 in the good category (Pratiwi, 2024). These findings confirm that student responses are a crucial factor in the successful implementation of the CPS model in the classroom.

In addition to the selection of the learning model, the approach used also determines the meaningfulness of the learning process. The ethnomathematics approach serves as a bridge between abstract mathematical concepts and the cultural realities familiar in students daily lives. Ethnomathematics is mathematics learning grounded in culture (Putri, Suanto, & Hutapea, 2025). This approach aims not only to improve mathematical understanding but also to foster appreciation for local wisdom and cultural values (Putri et al., 2025). Various studies have demonstrated the effectiveness of ethnomathematics; for example, ethnomathematics learning based on traditional games has proven effective in enhancing students understanding of mathematical concepts (Hidayah, 2026). Similarly, the development of ethnomathematics-based e-LKPDs has proven effective in improving mathematical problem-solving skills, with the experimental class achieving an N-Gain of 0.57, higher than the control classs 0.33 (Khasanah, 2026). More broadly, a systematic literature review also concluded that ethnomathematics-based learning can help improve student learning outcomes (Marinda, 2024). Furthermore, ethnomathematics has been identified as an effective scaffolding approach to help students overcome learning difficulties by connecting school mathematics with students lived experiences and cultural practices (Hidayah & Wijaya, 2023; Sari & Permatasari, 2025; Devita et al., 2025; Rahmawati & Suryadi, 2026).

In the context of local culture, Jepara possesses a rich cultural heritage, one of which is Troso woven fabric. Various studies have explored the ethnomathematical values within these weaving patterns. Lestari (2025) demonstrated that Troso woven fabric patterns contain elements of plane geometry, specifically triangles and quadrilaterals. Other research also confirms that nearly all patterns of Jeparas Troso woven fabric can be applied as tools for understanding geometric concepts. More specifically, Maisaroh and Permatasari (2024) found that Troso weaving motifs involve geometric transformation concepts such as translation, rotation, reflection, and dilation, making them highly relevant for mathematics learning in junior high school under the Merdeka Curriculum. Therefore, Troso weaving motifs are not only rich in artistic and cultural value but also hold great potential as a contextual learning resource for quadrilaterals and triangles.

Learning about quadrilaterals and triangles is one of the key foundations of geometry in seventh grade. Unfortunately, students often struggle to understand the properties of these shapes, distinguish between similar types, and apply perimeter and area formulas to contextual problems. Studies have identified various student difficulties, including conceptual errors in defining quadrilaterals and triangles, confusion in determining appropriate formulas, and a tendency to memorize rather than understand the material (Wahyuni & Suryadi, 2021; Lestari & Zanthy, 2020; Damayanti & Kartini, 2022). These difficulties call for an approach that can visualize concepts in a more concrete and meaningful way. Ethnomathematics offers a solution by incorporating cultural contexts, such as the Troso Weaving motif, as a medium for directly and meaningfully recognizing and analyzing various geometric shapes.

Based on this description, this study integrates the Creative Problem Solving model with an ethnomathematics approach using the Troso Weaving motif in the teaching of quadrilaterals and triangles. However, unlike most quantitative studies that focus on measuring the impact on learning outcomes or problem-solving skills, this study specifically aims to describe students responses to the implementation of the Creative Problem Solving model with an ethnomathematics-based Troso Weaving approach in the Quadrilaterals and Triangles curriculum for Grade 7. Focusing on student responses is crucial to understanding the extent to which this model is accepted, enjoyed, and perceived as beneficial by students as the primary subjects of learning. Thus, the results of this study are expected to provide an in-depth empirical picture of students perceptions of the integration of the CPS model and Troso weaving ethnomathematics in geometry learning, while also serving as a basis for consideration by teachers and other researchers in developing mathematics learning that is more contextual, innovative, and student-centered.

METHODS

This study employs a quantitative descriptive approach aimed at describing students responses to the implementation of the Creative Problem Solving (CPS) model with an ethnomathematics focus on Troso weaving in the study of quadrilaterals and triangles in seventh grade. The research subjects were 27 seventh-grade students at SMP Negeri 2 Welahan Jepara, selected using purposive sampling (Sugiyono, 2019) because the school is located in a region known for producing Troso Weaving and the students were already familiar with the motifs of this traditional fabric. It is important to acknowledge that the number of subjects was limited to 27 students from a single school, which restricts the generalizability of the findings. Consequently, the results should be interpreted as an initial descriptive portrait of student responses within this specific context, rather than as broadly representative conclusions. Future studies with larger and more diverse samples are recommended to confirm these findings.

The primary instrument used was a student response questionnaire developed based on response indicators according to Nur and Wiguna (2022) and Rahmawati and Dwi (2021). The questionnaire consists of 16 items covering five aspects: (1) interest in the CPS model, (2) ease of understanding the material through ethnomathematics, (3) student activities and participation, (4) the benefits of the CPS model in problem-solving, and (5) positive attitudes toward local culture. These five aspects were deliberately selected because they represent the core dimensions of student affective responses identified in the theoretical frameworks of Nur and Wiguna (2022) and Rahmawati and Dwi (2021). Specifically, these dimensions capture both the cognitive-affective engagement, including interest, ease of comprehension, and active participation, and the socio-cultural relevance, including perceived benefits of the model and appreciation for local cultural heritage. Together, these aspects provide a comprehensive measure of student receptivity to the integration of the CPS model with local cultural content, covering how students feel, think, and behave during and after the learning process.

Before use, the questionnaire underwent content validation by two experts, namely a mathematics lecturer and a certified junior high school mathematics teacher. The validation process employed a scoring rubric assessing four criteria: (1) relevance of each item to the measured aspect, (2) clarity of language and instructions, (3) appropriateness of the items for the cognitive level of seventh-grade students, and (4) alignment of the items with the operational indicators. Each expert rated every item on a 1-to-4 scale, where 1 indicated "not suitable," 2 indicated "less suitable," 3 indicated "suitable," and 4 indicated "very suitable." The Content Validity Index (CVI) was then calculated based on the proportion of items rated 3 or 4 by both experts. The instrument achieved a CVI value of 0.80 or higher, meeting the minimum acceptable standard for content validity (Arikunto, 2019). Following content validation, the questionnaire was tested for reliability with a pilot group of 20 students who had similar characteristics to the research subjects. The reliability coefficient was calculated using Cronbachs Alpha, yielding a value of 0.87, which falls into the very high category (Arikunto, 2019).

In addition to the questionnaire, brief observations were conducted during the learning sessions to supplement the primary data. The observations focused on three explicit aspects: (1) student engagement during each stage of the CPS syntax, including the level of enthusiasm and focus shown by students, (2) collaborative interactions in group discussions, including the extent to which students shared ideas, listened to peers, and worked together to solve problems, and (3) students ability to identify and relate Troso weaving motifs to geometric concepts, particularly in recognizing shapes, patterns, and spatial relationships. The instrument used for observation was a structured checklist containing these three aspects with a four-point rating scale, accompanied by descriptive field notes to capture qualitative details of classroom dynamics, student questions, and unexpected incidents that emerged during instruction. The observation data served as supporting evidence to triangulate the questionnaire results and provide richer contextual understanding.

The research procedures were implemented over four instructional sessions, each lasting 90 minutes. The detailed implementation of the CPS model integrated with Troso weaving ethnomathematics was as follows. Session 1 focused on the first CPS syntax stage, understanding the challenge. The teacher introduced the CPS model and its syntax to students. Students were then shown various Troso woven fabric samples and photographs of traditional motifs. They were asked to observe and identify basic quadrilaterals, such as squares, rectangles, rhombuses, and parallelograms, as well as various types of triangles based on angles and sides, that appear in the geometric ornaments of the fabrics. For example, students identified triangular shapes in the "kawung" motif and rectangular grids in the "truntum" arrangement. Session 2 emphasized the second CPS syntax stage, generating ideas. Students worked in small groups to analyze the mathematical properties of triangles and quadrilaterals by exploring the spatial arrangements of weaving motifs. They were given grid paper depicting simplified Troso patterns and asked to measure the number of symmetry lines, identify parallel and perpendicular sides, and classify the types of triangles found within the motifs. For instance, students calculated the angles of a triangular patch used in a traditional fabric design, directly connecting the visual patterns to formal geometric definitions. Session 3 integrated the third and fourth CPS syntax stages, planning actions and implementing solutions. Students were presented with contextual word problems about designing a woven fabric patch with specific dimensions. They were required to calculate the perimeter and area of various composite geometric shapes derived from the motifs, plan their calculation strategies collaboratively, and solve the problems systematically. An example problem was: "A traditional Troso fabric has a rhombus-shaped ornament with a side length of 10 cm and a diagonal length of 16 cm. Calculate the area of the ornament." Students applied the CPS model to plan the steps needed to solve such problems. Session 4 emphasized the review and reflection stages of the CPS syntax. Students presented their group solutions to the class, explained their reasoning, and discussed alternative strategies. They also created their own motif-inspired geometric compositions on grid paper, explaining the mathematical reasoning behind their designs. At the end of this session, the student response questionnaire was administered.

Following the completion of the four instructional sessions and the questionnaire administration, data were analyzed descriptively. The mean scores for each aspect and the overall score were calculated using Microsoft Excel, and the results were then converted into the following criteria: 3.25 to 4.00 was categorized as very positive, 2.50 to 3.24 as positive, 1.75 to 2.49 as negative, and 1.00 to 1.74 as very negative (Sudaryono, 2019). The results of the analysis are presented in the form of tables and interpretive narratives. Observation data in the form of field notes and checklist scores were analyzed qualitatively to support and enrich the quantitative findings from the questionnaire.

RESULTS AND DISCUSSION

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Based on an analysis of survey data regarding student responses to the implementation of the Creative Problem Solving (CPS) model with an ethnomathematics focus on Troso weaving in lessons on quadrilaterals and triangles, it was found that, overall, student responses fell into the positive category, with an average score of 3.19 on a scale of 4.00 (Sudaryono, 2019).

Table 1. Distribution of Students' Average Response Scores

No.	Aspect Measured	Number of Items	Mean Score	Category
1	Interest in the CPS Model	3	3.42	Very Positive
2	Ease of Understanding Material through Ethnomathematics	4	3.15	Positive
3	Participation and Activity during Learning	4	3.02	Positive
4	Benefits of the CPS Model in Problem-Solving	3	3.09	Positive
5	Positive Attitude toward Local Culture	3	3.20	Positive
	Total / Overall	**16**	**3.19**	**Positive**

Category Descriptions:
3.25 – 4.00 = Very Positive
2.50 – 3.24 = Positive
1.75 – 2.49 = Negative
1.00 – 1.74 = Very Negative
(Sudaryono, 2019)

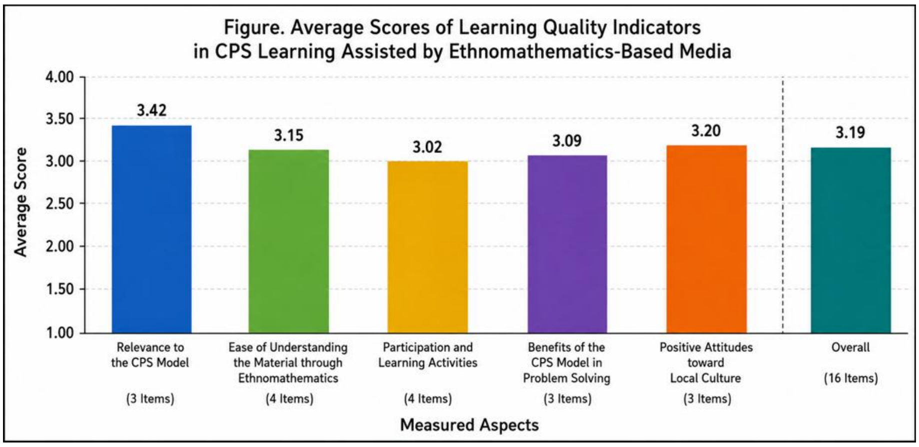

Figure 1. Distribution of Students' Average Response Scores

Of the five aspects measured, which were broken down into 16 statements, students' interest in the CPS model received the highest score of 3.42 (very positive category), indicating that students were enthusiastic and interested in learning through a creative problem-solving approach linked to the local Troso weaving culture (Rahmawati & Dwi, 2021). The aspect of ease in understanding the material through ethnomathematics received an average score of 3.15 (positive category), meaning students felt assisted in understanding the concepts of quadrilaterals and triangles when linked to fabric patterns and weaving tools. The aspect of student participation and activity during learning, measured by 4 items, scored 3.02 (positive), while the aspect of the benefits of the CPS model in mathematical problem-solving, consisting of 3 items, reached a score of 3.09 (positive). The aspect of positive attitudes toward local culture, measured by 3 items, received an average score of 3.20 (positive), indicating that this learning also fostered students' appreciation for the cultural heritage of Troso Weaving (Nur & Wiguna, 2022).

Table 2. Distribution of Students' Average Response Scores

Category	Number of Items	Percentage
Positive – Very Positive	13	81.25%
Negative	3	18.75%

More specifically, of the 16 items, 13 (81.25 percent) scored in the positive to very positive range, while 3 (18.75 percent) fell into the negative category with scores between 1.75 and 2.49. The three items with negative responses were primarily related to: (1) students' ability to solve contextual story problems independently without teacher assistance (score 2.05), (2) students' confidence in designing solution steps during the planning actions stage of the CPS syntax, and (3) students' perception that group discussions were not evenly distributed among all members. The item with the lowest score (2.05) was the statement regarding independent problem-solving, indicating that although the CPS model is helpful, some students still require intensive guidance in solving complex problems (Lestari & Yudhanegara, 2020).

Supporting observation results provide richer contextual detail that validates the questionnaire findings. During the four instructional sessions, observers noted that students were highly engaged and actively asked questions when exploring the geometric shapes embedded in Troso weaving motifs, such as identifying rhombuses in the kawung pattern and triangles in the crab motif. Students enthusiastically measured sides, identified parallel and perpendicular lines, and discussed the properties of various quadrilaterals directly from fabric pattern grids. However, the observations also consistently revealed that when students transitioned from the visual exploration phase to the independent problem-solving phase, particularly when faced with contextual word problems requiring multi-step reasoning, many students exhibited hesitation, paused their writing, and frequently looked toward the teacher for confirmation. This behavior indicates a reliance on external validation rather than internal reasoning, which aligns with the low score on the independent problem-solving item. Additionally, observers noted that in several groups, more dominant students tended to lead the discussions and calculations, while quieter students passively agreed without actively contributing to the cognitive reasoning process, which supports the negative perception regarding uneven group participation. Overall, student responses to the CPS model with Troso Weaving ethnomathematics elements were positive and warrant further implementation, though with critical attention to the identified weaknesses.

Discussion

The results of the study indicate that, overall, students' responses to the Creative Problem Solving (CPS) model incorporating Troso weaving ethnomathematics fell into the positive category, with an average score of 3.19. This finding indicates that the integration of the CPS model, which emphasizes creative problem-solving, with local cultural values is capable of creating a more engaging and meaningful learning environment for students (Rahmawati & Dwi, 2021). This aligns with the view of Isrok'atun and Amelia (2020) that the ethnomathematics approach can bridge abstract mathematics with students' concrete experiences rooted in their cultural environment.

The aspect of student interest in the CPS model received the highest score (3.42). This high level of interest stems from the systematic steps of the CPS model, which provide both creative freedom and challenges for students (Prabawati & Herman, 2021). Additionally, the ethnomathematical elements of Troso Weaving, presented through fabric motifs, weaving patterns, and looms, make mathematics feel less foreign. Students feel proud that their local culture is incorporated into learning, thereby increasing their motivation to learn (Nur & Wiguna, 2022). This finding supports the research by Sari and Wijaya (2022), which states that a cultural context closely tied to students' daily lives significantly enhances interest and active participation. Observations corroborated this, as students visibly showed enthusiasm and curiosity when identifying geometric shapes in the fabric patterns, often sharing personal stories about seeing their parents or relatives weave at home.

The aspect of ease of understanding the material (score 3.15) also falls into the positive category. Quadrilaterals and triangles, which are often considered abstract, become more concrete when linked to geometric shapes in Troso weaving motifs, for example, squares in the pakan pattern and triangles in the crab motif. Fitriani and Nurfauziah (2024) explain that abstraction in geometry can be facilitated by presenting real-world objects that possess geometric properties. Thus, ethnomathematics functions as an epistemological bridge that helps students build conceptual understanding from the concrete to the abstract (Wahyuni & Hidayat, 2023). During observations, students were able to accurately measure the sides of rhombus-shaped ornaments and calculate their perimeters when prompted, demonstrating that the visual-concrete connection successfully supported initial conceptual comprehension.

However, the findings that warrant the most critical attention are the three items falling into the negative category, particularly the lowest-scoring item regarding students' ability to solve contextual story problems independently (score 2.05). A deeper critical analysis reveals that this difficulty is not merely a lack of practice but is rooted in several interconnected factors. First, students in this cohort have historically been conditioned to teacher-centered, algorithm-based instruction where the primary expectation is to mimic formula application rather than construct meaning independently. When confronted with the open-ended, multi-step demands of the CPS model, particularly in non-routine story problems, they experienced cognitive overload and reverted to passive waiting behavior. Within Polya's (1973) framework, these difficulties predominantly occur during the devising a plan and carrying out the plan stages, especially when problems do not directly resemble the provided examples (Putri & Hasanah, 2022). Second, the linguistic and contextual complexity of story problems, even when framed with local cultural contexts like Troso weaving, still posed a reading comprehension barrier for some students, causing them to struggle with translating the narrative into mathematical equations and solution sequences. Third, observations confirmed that students lacked sufficient prerequisite skills in algebraic reasoning and spatial visualization to autonomously generate accurate solution plans. When the teacher gradually withdrew scaffolding, many students were unable to independently synthesize the steps they had practiced under guidance, indicating a fragile grasp of the underlying mathematical structure rather than a robust conceptual understanding.

Furthermore, the negative responses related to the planning actions stage and uneven group participation provide additional critical feedback. The difficulty in the planning stage suggests that students are not yet accustomed to articulating their own strategies before executing them, as traditional instruction typically provides ready-made solution procedures. This implies that future CPS implementations must allocate more time to explicitly modeling and scaffolding the planning process, perhaps through guided worksheets that prompt students to write down their planned steps before calculating. Regarding the uneven group participation, observations revealed that quieter students often remained passive while more dominant peers took over the problem-solving tasks. This indicates that simply assigning group work is insufficient; teachers should incorporate structured roles within groups, such as a strategy planner, a calculator, a presenter, and a checker, to ensure every student actively contributes to each stage of the CPS syntax.

The positive attitude toward local culture (score 3.20) indicates that students developed a sense of pride in recognizing their heritage within formal mathematics. However, it is important to note that this positive sentiment does not automatically translate into higher-order mathematical competence. Enthusiasm for identifying motifs did not always correspond with the ability to derive abstract geometric generalizations from them, suggesting that teachers must deliberately bridge the gap between concrete motif observation and formal geometric proof. The worksheet development proposed in this study, integrating Troso weaving motifs into structured CPS stages with progressive scaffolding, represents a strategic step to maintain student interest while systematically building independence. By presenting initial problems within the familiar Troso context and gradually introducing variations in broader contexts, students can develop transferable problem-solving skills without losing the motivational benefits of cultural relevance (Sari & Wijaya, 2022).

Finally, it is imperative to explicitly acknowledge the limitations of this study. The research involved only 27 students from a single school, SMP Negeri 2 Welahan Jepara, where the Troso weaving culture is native and deeply embedded in the local community. Therefore, the highly positive responses observed are likely influenced by the students' familiarity with and proximity to the cultural artifacts used. In other schools located outside the Jepara region, where students may have no prior exposure to Troso weaving, the integration of this specific motif might not evoke the same level of interest or ease of understanding, and might even introduce an additional layer of unfamiliarity that hinders comprehension. Consequently, while the CPS model itself can be adapted universally, the ethnomathematics component must be carefully tailored to the local cultural context of each respective school. Teachers in different regions are advised to select culturally relevant artifacts from their own local wisdom, such as traditional houses, local crafts, or regional dances, to maintain the contextual meaningfulness of the instruction. Future research should involve larger and more diverse sample sizes across multiple schools, including urban and rural settings, to test the robustness of these findings and to develop standardized yet flexible adaptation guidelines for implementing ethnomathematics-based CPS in varied cultural and geographical contexts.

CONCLUSION

Based on the results of the questionnaire data analysis and observations, it can be concluded that the overall response of seventh-grade students to the implementation of the Creative Problem Solving (CPS) model with an ethnomathematics focus on Troso weaving in the quadrilaterals and triangles unit falls into the positive category. The aspect of student interest in the CPS model received the highest score in the “very positive” category, indicating that a creative problem-solving approach linked to local culture is effective in enhancing students’ enthusiasm and interest in learning. The aspects of ease of understanding the material, student participation and activities, the benefits of the CPS model in problem-solving, and a positive attitude toward local culture also fall within the positive category. However, students still face difficulties regarding independence in solving word problems, as indicated by the lowest score on the statement regarding the ability to solve problems independently without teacher assistance. This suggests that while the CPS model is helpful, some students still require intensive guidance and more varied practice problems. Overall, the CPS model with a torso woven fabric ethnomathematics nuance is worthy of implementation as an alternative for contextual, creative, and culturally aware mathematics learning, provided that there is reinforcement during the independent practice phase and guidance for students who are still experiencing difficulties.

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Declarations

Author Contribution	:	Author 1: Conceptualized the study, developed the methodology, collected and analyzed the data, and wrote and revised the manuscript; Author 2: Supervised the research, validated the instrument, and critically reviewed and edited the manuscript.
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Conflict of Interest	:	The authors declare no conflict of interest.
Generative AI Statement	:	This paper was assisted by AI tools, including ChatGPT for translation, text refinement, and coherence enhancement, as well as Grammarly for proofreading. These tools were used to improve readability and adherence to academic standards. The authors are fully responsible for the content and interpretations presented.
Additional Information	:	The raw questionnaire data supporting the findings are available from the corresponding author upon reasonable request. Ethical approval was obtained from the school principal, and all student participants as well as their parents/guardians provided informed consent prior to the study.

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