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A Psychological Perspective on Students' Attitudes Toward Mathematics and Self-Confidence in Contextual Role-Playing Learning

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ABSTRACT

The research examined the implementation of contextual role-play learning and its relationship with students' attitudes toward mathematics and self-confidence from a psychological perspective. A quantitative approach was employed using descriptive and inferential analyses. The population comprised Grade VII students enrolled at a public junior secondary school in rural Karanganyar, Surakarta, during the 2025/2026 academic year. Data were collected from March to May 2026. The sample consisted of 290 students aged 12–13 years, including 111 students who participated in contextual role-play learning and 179 students who participated in non-role-play learning. Participants were selected using cluster random sampling. Significant between-group differences were found in students' attitudes toward mathematics ($p = .004$), particularly perceived anxiety ($p < .001$). The engaging, enjoyable, and cooperative environment created through role-play activities helped students participate more comfortably in mathematics lessons. Contextual role-play learning was also associated with higher mathematics self-confidence ($p < .001$), particularly in the self-confidence ($p < .001$) and success-orientation ($p < .001$) dimensions. Psychologically, contextual role-play learning supported confidence by reducing perceived anxiety and making mathematics more meaningful, interactive, and connected to real-life experiences. The findings suggest that contextual role-play activities can create a supportive learning environment that strengthens students' confidence in achieving success in mathematics.

Key Words: *attitudes toward mathematics; contextual role-play learning; mathematics anxiety; mathematics self-confidence; psychological perspective*

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1. INTRODUCTION

Mathematics remains one of the subjects most frequently perceived by students as difficult. It is often regarded as challenging and only weakly connected to everyday life. Early exposure to numeracy, however, is crucial for developing students' intellectual foundations and analytical abilities. Enjoyable engagement with mathematics can motivate students to improve their reasoning and problem-solving abilities. Contextual mathematics education should therefore incorporate students' surroundings and align with their developmental progression from concrete to abstract understanding (Aranditio, 2026). Such perceptions can have systemic consequences, including low mathematical proficiency in both cognitive and non-cognitive dimensions.

Mathematical skills in cognitive and non-cognitive areas are important and interconnected (Xiao et al., 2025). Mathematics anxiety plays a role in the relationship between learning engagement and

achievement. Non-cognitive skills have been shown to be statistically significant predictors of cognitive ability (Pitsia et al., 2017). Attitudes toward mathematics and self-confidence represent students' non-cognitive abilities. The measurement invariance of non-cognitive attitude-toward-mathematics scales has been examined in educational evaluation. The TIMSS 2019 scales were examined using an item response theory modeling technique within a partial invariance framework (Reynolds et al., 2022). Secondary analyses of the TIMSS mathematics self-confidence scale were also conducted (Asp, 2026).

Students' non-cognitive skills, particularly their attitudes toward mathematics and self-confidence, are crucial factors that should be strengthened to support higher levels of mathematical achievement. Comprehensive educational efforts are therefore needed. Evidence from several studies supports this view; playful learning with DragonBox Algebra can enhance positive engagement in mathematics and improve mathematical understanding (Bernier et al., 2026). A study using innovative and contextual role-playing learning tools found that 89.28% of students achieved a high level of mathematical communication skills (Hasanah et al., 2024). Contextual teaching and learning has also been shown to improve students' mathematics learning outcomes (Fathurrahman, 2024). Contextual learning may offer a feasible approach to enhancing conceptual understanding and numeracy literacy (Salsabila et al., 2026). Effective implementation depends on teacher innovation, student involvement, and institutional support, despite challenges related to time management and differences in student abilities, as illustrated by the use of number cards in a contextual learning model (Ritonga et al., 2025). Students in contextual learning settings have also described mathematics lessons as more enjoyable and accessible, leading to more positive attitudes toward mathematics (Aykan, 2024).

The findings of these studies indicate that contextual mathematics learning can enhance students' cognitive and non-cognitive abilities. Role-playing, as a form of contextual learning, offers one possible approach. Role play is a specific type of play that includes sociodramatic, imaginative, and fantasy elements and allows learners to experience life from another person's perspective (Williams, 2015). Play-based settings for science and mathematics have shown that independent play can help children develop thinking, relational, and emotional understanding alongside academic progress, which is important for forming a science identity (Bachman, J., & Dierking, 2011). Role-playing contexts have also been shown to enhance students' self-efficacy (Somakim, Darmawijoyo, Eliyati, N., 2019).

Interactive and engaging learning strategies are essential. One promising approach is the use of role-playing games, which provide students with opportunities to learn through active participation by taking on roles in educational scenarios. The use of role-playing game media has proven effective in improving students' performance in mathematics learning (Masruroh et al., 2025). Role-play lesson plans have also positively influenced teachers' understanding, knowledge, and awareness (Kinasih & Hardiani, 2020). Role-playing game media create a more dynamic, interactive, and contextual learning environment, enhancing conceptual understanding and supporting students' mathematics performance (Masruroh et al., 2025). Such media can also align with the curriculum and support mathematical understanding (Taufik et al., 2024). Other examples include DragonBox Algebra (Bernier et al., 2026) and Arithmetic Adventure (Nurrosyadah & Susanti, 2026). Mathematics games are a popular approach to teaching mathematics in an exciting and engaging way for children (DePascale & Ramani, 2025). Mathematics games have also been proposed as instructional media (Bt Wan et al., 2010). Role-playing games have become an engaging instructional medium in mathematics education. An evaluation examined the effects of such games on students' understanding of mathematical concepts (Taufik et al., 2024).

Role-playing in mathematics learning can take many forms, as exemplified by (Ellis et al., 2025). One form of role-playing learning was examined by (Barnett, 2007), who asked 649 students to evaluate their own playfulness and related characteristics and to identify and assess others as highly or minimally playful. Fifteen characteristics were identified as

distinctive features of playful individuals and were grouped into four core traits: sociable, unrestrained, humorous, and energetic. Participants reported that playfulness and its core traits were described similarly, whether identified in themselves or in others.

The research aimed to investigate the implementation of contextual role-playing learning and its effects on public junior high school students' attitudes toward mathematics and self-confidence from a psychological perspective. The analysis examined whether role-playing learning could improve these non-cognitive abilities. Attitudes toward mathematics and self-confidence were selected because students' perceptions of themselves as mathematics learners and their confidence in their abilities contribute to mathematics learning and achievement (Schoenfeld, 1992); (House, 2000). A positive attitude toward mathematics can also improve performance (Alpacion et al., 2014).

Despite growing evidence that contextual learning and role-playing can enhance mathematics learning, relatively little research has examined their simultaneous influence on students' attitudes toward mathematics and self-confidence from a psychological perspective, particularly among junior high school students. The research addresses that gap by investigating the relationship between contextual role-playing and these two interconnected non-cognitive outcomes and by considering its potential to support students' psychological readiness for mathematics learning.

2. METHOD

A quantitative design combined descriptive and inferential analyses to examine statistically significant differences between groups through a quasi-experimental or causal-comparative approach focusing on secondary school students' attitudes toward mathematics and self-confidence. The population comprised Grade VII students enrolled in the 2025/2026 academic year at a public secondary school in rural Karanganyar, Surakarta, and data were collected from March to May 2026. The participants included all 290 Grade VII students, aged 12–13 years. Cluster random sampling produced a role-playing group of 111 students and a non-role-playing group of 179 students.

Role-playing was conducted using a worksheet on linear equations in one variable designed as a sales simulation. During the activity, the class was divided into two large teams: stationery and food and beverage. The two teams were then divided into sellers and buyers. The assigned roles encouraged active learning and involved all students. In the first stage, the sales team received a worksheet containing contextual problems related to everyday situations, such as buying stationery and snacks and calculating discounts. Each problem required students to formulate a linear equation in one variable and solve it to determine an item's unit price. The sales team followed a systematic and iterative process. In each activity, team members first addressed the worksheet problem by constructing a mathematical model and determining the value of the variable. Once the calculations were complete, the sales team asked the teacher to verify the accuracy and completeness of their answers. The verification process ensured that the results used in the transaction were accurate. After the answers had been verified as correct and complete, the sales team proceeded to the next stage and sold the goods.

A group of buyers then arrived with purchase coupons to complete a transaction. The seller processed each purchase by completing the coupon as a receipt and stating the total purchase price and change, but not the unit price. Once the transaction was complete, the process was repeated: the seller proceeded to the next worksheet problem, completed the calculation, asked the teacher for verification, and, after approval, returned to serve the next buyer. The pattern continued until all activities in the student worksheet had been completed. Through this repeated process, students in the sales group practiced solving problems and experienced the full cycle, from problem solving to validating results and applying them in a transactional context. Direct application after calculation strengthened their conceptual understanding.

Meanwhile, the buyers' group was given a purchase coupon containing information such as the name of the item, quantity, amount paid, and change, but not the unit price. The buyer handed the coupon to the seller to complete as a receipt. After receiving the completed coupon, the buyers constructed a mathematical model from the available information to

determine the unit price of the item independently. The activity continued in stages until all problems in the student worksheet had been completed in a competitive yet enjoyable atmosphere.

Descriptive analysis included visual and numerical analyses of the research variables, while inferential analysis initially compared students' attitudes toward mathematics and self-confidence using the Mann–Whitney U test (Pramesti, 2017). Subsequent inferential analysis examined the components of both variables. The analysis addressed two research variables—students' attitudes toward mathematics and self-confidence—and considered their relationship with performance. Students' attitudes toward mathematics were measured using the Mathematics Attitude Scale (MAS) developed by (Facultada & Sebialb, 2019). Although originally developed for upper-secondary students in the Philippines, the MAS was selected because (1) the participants' age range begins at 12 years; (2) its components represent the relevant dimensions of attitudes toward mathematics; and (3) Indonesia and the Philippines share a Southeast Asian educational context and have education systems aligned with global standards (Facultada & Sebialb, 2019). Students' understanding of and self-confidence in mathematics were measured using the questionnaire developed by (Nurmi et al., 2003). Mathematics self-confidence (MSC) comprises self-confidence, success orientation, and defence orientation, as shown in the Appendix. The instruments (see Appendix) contain 33 and 19 items, respectively, and use a five-point Likert-type scale ranging from 1 (never) to 5 (very frequently). Corrected item–total correlations were used to assess item validity (Hajjar, 2018). Cronbach's alpha was used to assess reliability (Madadizadeh & Bahariniya, 2025). After instrument validity and reliability had been established, inferential analysis was performed using an appropriate technique for two independent samples. Before inferential testing, the assumptions of normality and homogeneity of variance were examined using the Kolmogorov–Smirnov and Levene tests, respectively (Pramesti, 2017). All analyses were conducted in SPSS using a significance level of 5%.

3. RESULTS

Before the students' mathematics attitude instrument was used, its validity and reliability were assessed. The item-validity results for the mathematics attitude instrument are shown in Table 1.

Table 1. Validity of all items in the Mathematics Attitude Scale (MAS)

Item	Pearson correlation	p (two-tailed)
M1	0.344	< .001
M2	0.335	< .001
M3	0.466	< .001
M4	0.217	< .001
M5	0.482	< .001
M6	0.328	< .001
M7	0.344	< .001
M8	0.510	< .001
M9	0.350	< .001
M10	0.473	< .001
M11	0.456	< .001
M12	0.420	< .001
A1	0.161	0.006
A2	0.195	0.001
A3	0.291	< .001
A4	0.217	< .001
A6	0.283	< .001
A7	0.338	< .001
A8	0.359	< .001
A9	0.298	< .001
A10	0.315	< .001
SE1	0.396	< .001
SE2	0.358	< .001
SE3	0.333	< .001
SE4	0.427	< .001
SE5	0.387	< .001
SE6	0.304	< .001
PI1	0.508	< .001
PI2	0.437	< .001
PI3	0.567	< .001
PI4	0.260	< .001
PI5	0.139	0.018

As shown in Table 1, item A5 was invalid because its significance value exceeded .05 (p = .174). Item A5 was therefore removed. The item-validity results for the mathematics attitude questionnaire after the removal of A5 are shown in Table 2.

Table 2. Validity of the Mathematics Attitude Scale (MAS) after excluding A5

Item	Pearson correlation	p (two-tailed)
M1	0.344	< .001
M2	0.335	< .001
M3	0.466	< .001
M4	0.217	< .001
M5	0.482	< .001
M6	0.328	< .001
M7	0.344	< .001

M8	0.510	< .001
M9	0.350	< .001
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PI2	0.437	< .001
PI3	0.567	< .001
PI4	0.260	< .001
PI5	0.139	0.001

Table 2 shows that all significance values were below .05, indicating that all retained items were valid. The reliability coefficient of the questionnaire after excluding A5 is shown in Table 3.

Table 3. Reliability of the Mathematics Attitude Scale (MAS)

Cronbach's alpha	N
0.764	34

Based on Table 3, Cronbach's alpha was .764. A coefficient of .764 indicates satisfactory internal consistency. The validity of the Mathematics Self-Confidence Scale (MSC) was then assessed, as shown in Table 4.

Table 4. Validity of all items in the Mathematics Self-Confidence Scale (MSC)

Item	Pearson correlation	p (two-tailed)
SC1	0.324	< .001
SC2	0.321	< .001
SC3	0.296	< .001
SC4	0.272	< .001
SC5	0.136	0.020
SC6	0.169	0.004
SC7	0.267	< .001
SC8	0.244	< .001
SC9	0.271	< .001
SC10	0.397	< .001
SO1	0.272	< .001
SO2	0.337	< .001
SO3	0.280	< .001
SO4	0.257	< .001
SO5	0.379	< .001
DO1	0.150	0.011
DO2	0.298	< .001
DO3	0.252	< .001
DO4	0.321	< .001

Table 4 shows that all items were valid. Accordingly, all questionnaire items were retained. The instrument's reliability is reported in Table 5.

Table 5. Reliability of the Mathematics Self-Confidence Scale (MSC)

Cronbach's alpha	N
0.623	20

As shown in Table 5, Cronbach's alpha was .623, indicating moderate reliability. The coefficient supported the use of the mathematics self-confidence instrument for data collection.

Next, normality and homogeneity of variance were examined to determine whether the parametric assumptions for quantitative analysis were satisfied. First, Table 6 reports the normality test results for students' attitudes toward mathematics.

Table 6. Kolmogorov–Smirnov test of students' attitudes toward mathematics

Item	p	Normality
MAS	< .001	X
MAS1	0.460	V
MAS2	< .001	X
MAS3	< .001	X
MAS4	< .001	X

K–S = Kolmogorov–Smirnov

Table 6 shows that the overall mathematics attitude score did not satisfy the normality assumption because $p < .001$. The same conclusion applied to MAS2, MAS3, and MAS4. The normality results for students' self-confidence are presented in Table 7.

Table 7. Kolmogorov–Smirnov test of students' mathematics self-confidence

Item	p	Normality
MSC	< .001	X
MSC1	< .001	X
MSC2	< .001	X
MSC3	< .001	X

K–S = Kolmogorov–Smirnov

Based on Table 7, mathematics self-confidence and all its components did not satisfy the normality assumption. The

homogeneity of variance for attitudes toward mathematics and mathematics self-confidence is reported in Tables 8 and 9.

Table 8. Levene's test of attitudes toward mathematics

Item	p	Homogeneity
MAS	0.174	V
MAS1	0.991	V
MAS2	0.004	X
MAS3	0.120	V
MAS4	0.960	V

Based on Tables 8 and 9, the overall attitudes toward mathematics and mathematics self-confidence scores met the homogeneity-of-variance assumption (MAS, p = .174; MSC, p = .076).

Table 9. Levene's test of mathematics self-confidence

Item	p	Homogeneity
MSC	0.076	V
MSC1	0.260	V
MSC2	0.040	X
MSC3	< .001	X

Based on the normality and homogeneity-of-variance results in Tables 7–9, inferential analysis was continued using nonparametric statistics. Table 10 shows the descriptive statistics for students' attitudes toward mathematics.

Table 10. Descriptive statistics for the Mathematics Attitude Scale (MAS)

Item	Mean	SD
MAS	107.672	10.159
MAS1	43.850	5.438
MAS2	28.210	4.484
MAS3	20.460	3.275
MAS4	15.160	2.787

Table 10 shows that the MAS1 factor had the highest mean and the greatest dispersion, whereas the MAS4 factor had the lowest mean and the lowest dispersion.

Table 11. Descriptive statistics for the Mathematics Self-Confidence Scale (MSC)

Item	Mean	SD
MSC	63.990	6.920
MSC1	32.540	3.845
MSC2	19.060	3.039
MSC3	11.880	2.616

Table 11 shows that self-confidence had the highest mean (M = 32.540) among the three components and also the greatest dispersion among the 290 students. Although self-confidence had the highest mean, it also showed the greatest variability. Table 12 presents the significance values for the overall scales and their components.

Table 12. Significance of students' attitudes toward mathematics and self-confidence

Item	U	p	Decision
MAS	11949.5	0.004	Reject H_0
MAS1	11221.0	0.063	Retain H_0
MAS2	12447.5	< .001	Reject H_0
MAS3	10033.0	0.886	Retain H_0
MAS4	10239.5	0.658	Retain H_0
MSC	12383.5	< .001	Reject H_0
MSC1	12497.0	< .001	Reject H_0
MSC2	13286.5	< .001	Reject H_0
MSC3	10860.5	0.178	Retain H_0

Note. U = Mann–Whitney U test.

Table 12 indicates a statistically significant difference between the role-playing and non-role-playing groups in students' attitudes toward mathematics (MAS, p = .004). Higher overall attitude scores favored the role-playing group. At the component level, a statistically significant difference was found in perceived anxiety during mathematics learning (MAS2, p < .001). As shown in Figure 1, the mean rank for attitudes toward mathematics was higher in the role-playing group (n = 111, mean rank = 163.65) than in the non-role-playing group (n = 179, mean rank = 134.25). The difference was statistically significant at the 5% level.

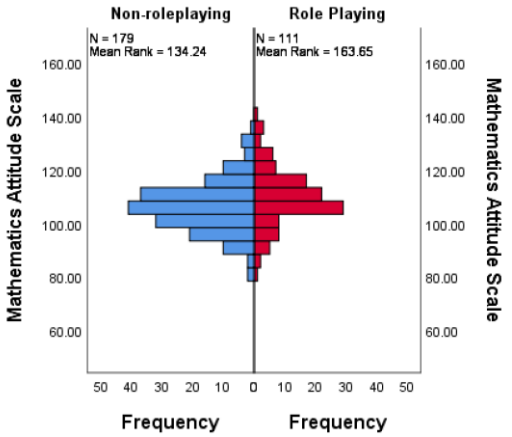


Figure 1. Mann–Whitney U test summary for students' attitudes toward mathematics

Table 12 also shows statistically significant differences in mathematics self-confidence (MSC, p < .001), particularly self-confidence (MSC1, p < .001) and success orientation (MSC2, p < .001). As shown in Figure 2, the mean rank for mathematics self-confidence

was higher in the role-playing group (n = 111, mean rank = 167.56) than in the non-role-playing group (n = 179, mean rank = 131.82). Consistent with Bandura's self-efficacy theory, contextual role-playing provided mastery experiences through the successful completion of authentic mathematical tasks and vicarious experiences through peer observation. Mastery and vicarious experiences can strengthen students' confidence in their mathematical abilities and their orientation toward success.

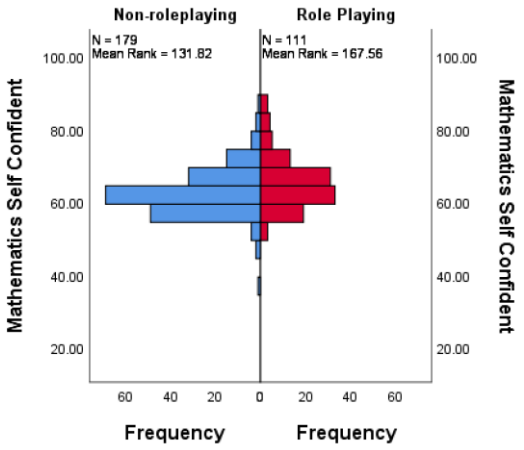


Figure 2. Mann–Whitney U test summary for students' mathematics self-confidence

Table 12 indicates that role-playing learning was significantly associated with students' self-confidence (MSC1, $p < .001$) and success orientation (MSC2, $p < .001$). As shown in Figure 3, the mean rank for students' self-confidence in the role-playing group was 168.59 (n = 111), whereas the mean rank in the non-role-playing group was 131.18 (n = 179). The difference in students' self-confidence between the role-playing and non-role-playing groups was statistically significant at the 5% level.

By engaging students in authentic mathematical situations, role-playing provided repeated opportunities for mastery through task completion, vicarious experiences through peer observation, and social persuasion through constructive feedback from teachers and peers, which Bandura identified as three primary sources of self-efficacy. Repeated mastery, observation, and feedback strengthened students' beliefs in their mathematical abilities, making them more confident in completing mathematical tasks and more oriented toward success. The mechanism helps explain the significantly higher self-confidence scores in the role-playing group.

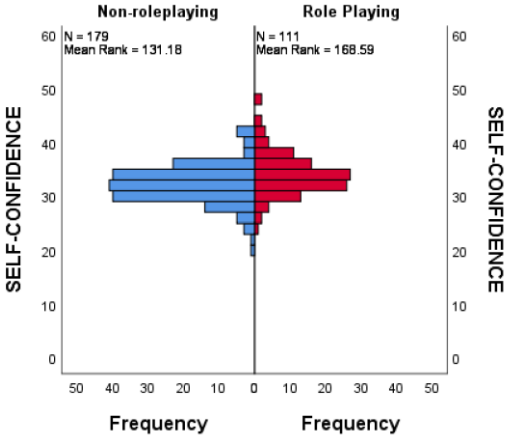


Figure 3. Mann–Whitney U test summary for students' self-confidence

Figure 4 shows that the mean rank for success orientation was higher in the role-playing group (n = 111, mean rank = 175.70) than in the non-role-playing group (n = 179, mean rank = 126.77). The difference in success orientation was statistically significant at the 95% confidence level.

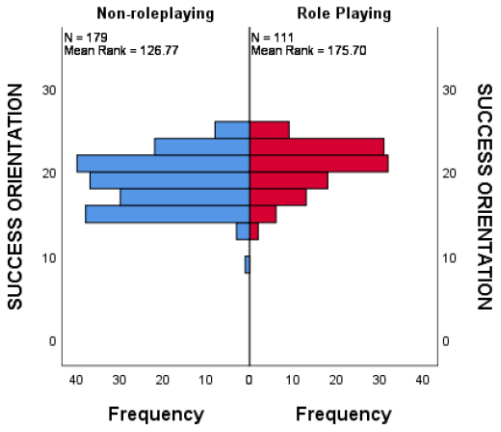


Figure 4. Mann–Whitney U test summary for students' success orientation

4. DISCUSSION

The results indicate that role-playing can improve students' attitudes toward mathematics, particularly by reducing perceived anxiety about learning the subject. A psychological interpretation of the finding draws on social constructivist theory. Effective learning occurs through social interaction and

collaboration (Vygotsky, 1978). In role-playing activities, students participate through interaction, discussion, and simulation rather than listening passively. Role-playing in contextual mathematics education can strengthen success orientation by making mathematics more relevant, interactive, and connected to real-life situations. Contextual learning requires students not only to remember formulas but also to apply mathematical concepts through active engagement and social interaction. Peer participation during role-playing provides social support that can reduce fear and stress during learning.

Transformational play suggests that educational games, including role-playing games, can connect learners, content, and the learning environment, allowing students to engage with material through meaningful experience rather than theory alone (Barab et al., 2010). Play and simulations can enhance learning by increasing student involvement and providing contextual and reflective opportunities (De Freitas, 2006). Role-playing also allows students to express themselves more openly, which can reduce emotional stress. In educational settings, students can experience academic situations without fear of immediate negative evaluation, thereby reducing learning anxiety (Moreno, 1946). Evidence from speaking contexts involving physical activity similarly shows that role-playing can reduce students' anxiety (Kaplan, 1992; Khasbani & Seli, 2021; Maldin & Sianipar, 2025; Toyib & Syafi'i, 2018). Games designed for students with mathematics anxiety should incorporate collaborative play, social interaction, adaptability, intrinsically motivating elements, and real-time assessments of anxiety (Dondio et al., 2023).

Role-playing was also associated with higher mathematics self-confidence, particularly success orientation. Self-efficacy, defined as belief in one's ability to complete a task, significantly influences academic motivation and achievement orientation (Bandura, 1997). Interactive role-playing can strengthen mathematics self-confidence by grounding abstract ideas in relatable real-world situations, reducing mathematics anxiety, fostering a growth mindset, and providing a safe setting for practice without fear of immediate failure (Angelica & Wulandari, 2025). Role-playing situations such as shopping, business transactions, or community problem solving help students recognize the relevance of mathematics to real-world contexts. Successful participation can strengthen confidence and self-efficacy.

A psychological interpretation also suggests that role-playing can improve attitudes toward mathematics by reducing perceived anxiety during learning. Mathematics anxiety often emerges when students perceive mathematical tasks as difficult, threatening, or beyond their capabilities. Role-playing activities provide collaborative, meaningful, and enjoyable experiences that shift attention from performance pressure to active participation. The resulting social interaction and supportive atmosphere allow students to express ideas, make mistakes, and explore solutions without fear of negative evaluation. Social constructivist theory suggests that peer interaction can reduce emotional barriers and foster psychological safety, thereby alleviating stress and anxiety associated with mathematics learning (Pekrun, 2006; Vygotsky, 1978).

Role-playing also enhances mathematics self-confidence, particularly self-confidence and success orientation. According to Bandura's self-efficacy theory, confidence develops through successful task completion, positive feedback, and observation of peers succeeding in similar activities (Bandura, 1997). Role-playing provides such opportunities by allowing students to apply mathematical concepts in authentic contexts and experience achievement in a low-pressure environment. As confidence in mathematical ability develops, students form stronger expectations of success and become more willing to engage with challenging tasks. Greater confidence and stronger expectations of achievement support success orientation, persistence, motivation, and a more positive attitude toward mathematics (Bandura, 1997; Dweck, 2006).

5. CONCLUSION

The findings indicate that contextual role-play learning was associated with more positive attitudes toward mathematics and stronger self-confidence among seventh-grade students. Psychologically, role-playing may help reduce perceived stress during

mathematics learning. Contextual role-playing was also associated with higher self-confidence and success orientation.

The contextual learning approach fosters an engaging, enjoyable, and cooperative environment that helps students participate more comfortably. Role-playing may therefore reduce students' anxiety. Role-playing in contextual mathematics learning can also strengthen success orientation by making mathematics more meaningful, interactive, and connected to real-life experiences. In contextual learning, students not only remember formulas but also apply mathematical concepts in realistic situations through active participation and social interaction.

The findings have important practical implications for mathematics education. Mathematics teachers are encouraged to integrate contextual role-playing into classroom instruction to promote positive attitudes toward mathematics and strengthen students' self-confidence. Schools and curriculum developers may consider incorporating role-playing activities into mathematics curricula to create more engaging and psychologically supportive learning environments, while educational psychologists can use the findings to design interventions that reduce mathematics anxiety and foster confidence and motivation to learn mathematics.

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