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Developing Contextual Teaching and Learning-Based Interactive Handouts: An Investigation into Students' Mathematical Problem-Solving Performance

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Abstract. *This research aims to develop an interactive handout based on Contextual Teaching and Learning (CTL) that meets the criteria of validity, practicality, and effectiveness. The development of this instructional medium was intended to enhance students' mathematical problem-solving skills, specifically regarding the topic of similarity for seventh-grade students at SMP Islam Sultan Agung 1 Semarang. This study employed a Research and Development (R&D) approach using the ADDIE model, which comprises the stages of analysis, design, development, implementation, and evaluation. The interactive handout was constructed utilizing various digital platforms, including Canva, Quizizz, Liveworksheet, and Heyzine. Data collection techniques involved validation sheets from media, material, and language experts, teacher and student response questionnaires, and pretest-posttest instruments. Validation results demonstrated high levels of validity, reaching 95.38% from media experts, 98.26% from material experts, and 95.56% from language experts. Practicality tests based on teacher and student feedback achieved scores of 87.5% and 94.4%, respectively. Furthermore, effectiveness testing—measured through individual and classical mastery, as well as N-Gain scores—indicated an improvement in posttest results with an N-Gain value of 0.7067, categorized as high. Consequently, the CTL-based interactive handout is declared valid, practical, and effective in enhancing students' mathematical problem-solving skills.*

Keywords: *Contextual teaching and learning (CTL), interactive handout, mathematical problem-solving.*

INTRODUCTION

The rapid advancement of technology and science continues to drive transformative changes across various sectors of life. Within the educational landscape, technology plays a pivotal role by facilitating students' access to information and scientific knowledge, thereby broadening their intellectual horizons (Maritsa et al., 2021). Consequently, educators are required to effectively integrate technological tools to enhance the learning process in schools. Technology is capable of optimizing student learning outcomes as it enables the exploration of prior knowledge and existing cognitive frameworks (Heru, 2018). Specifically, the

strategic utilization of technology in mathematics education streamlines the process of resolving complex problems (Saputra et al., 2023).

Problem-solving is conceptualized as a strategic competency demonstrated by students in comprehending and resolving complex challenges (Basir & Maharani, 2018; Umar et al., 2022). This competency is inherently fundamental and intrinsically linked to the field of mathematics. Specifically, mathematical problem-solving is defined as a rigorous intellectual activity that necessitates a robust conceptual foundation. It holds significant pedagogical urgency, as it serves as a cornerstone for future mathematical learning. This is further corroborated by the assertion that proficient mathematical problem-solving skills equip students with the analytical fortitude required to navigate challenges in professional environments (Ukobizaba et al., 2021).

Despite its theoretical importance, empirical evidence suggests that students continue to face substantial difficulties in resolving mathematical problems, as evidenced by the consistently low average numeracy scores in the Minimum Competency Assessment (AKM) (Rachmawati et al., 2024; Rohmah et al., 2022). Furthermore, surveys conducted by the Programme for International Student Assessment (PISA) indicate that numeracy proficiency across primary and secondary education levels remains substandard (Winata et al., 2021). Such deficiencies are particularly prevalent in the topic of geometric similarity, which students often perceive as challenging—especially when confronted with non-routine problems that demand complex problem-solving processes. Addressing this issue is a critical responsibility for educators, who must ensure that students develop the capacity to navigate mathematical challenges within this domain. This is especially vital given that geometric similarity holds extensive practical utility; while it may appear conceptually complex, its applications are ubiquitous and directly observable in everyday life.

Preliminary observations conducted at SMP Islam Sultan Agung 1 revealed that students encounter significant hurdles in mathematical problem-solving. According to the mathematics faculty, these challenges manifest as difficulties in interpreting word problems, translating contextual scenarios into mathematical

formulations, and articulating accurate conclusions. Such findings motivated the development of an interactive handout integrated with Contextual Teaching and Learning (CTL) to bolster students' mathematical problem-solving competencies. Given that geometric similarity is intrinsically tied to real-world applications and contextual problems, its inherent complexity can be mitigated through the implementation of a CTL framework, which bridges the gap between abstract mathematical concepts and students' everyday experiences.

Implementing the CTL model stimulates active learning by bridging the gap between students' prior knowledge and real-world applications (Maulidia et al., 2025). By centering the learning experience on familiar contexts, CTL fosters an environment that is both engaging and pedagogically meaningful. This model ensures that mathematical concepts taught in schools remain relevant to students' lives through robust contextual integration (Mallika, 2024; Riza et al., 2024). Furthermore, CTL is underpinned by seven core elements: constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment (Akmal et al., 2023). These seven pillars are meticulously integrated into the interactive handout developed in this study. Unlike traditional static materials, this interactive handout transcends textual content by incorporating instructional videos and interactive quizzes, aiming to cultivate a more dynamic and interactive learning atmosphere that bolsters students' enthusiasm for mathematics. The integration of interactive technology, multimedia, and visual aids empowers students to become more communicative and engaged participants in the classroom (Kalyani, 2024; Tohara, 2021).

The resulting interactive handout constitutes a valid, practical, and effective instrument for supporting the student learning process. Students can access this CTL-based resource via web links or QR code scans, enabling seamless utilization on smartphones regardless of location. Consequently, this product serves as a highly accessible instructional solution, effectively mitigating barriers to resource availability for its users.

RESEARCH METHOD

Various models are available as frameworks for developmental research; however, this study specifically employed the ADDIE developmental model (Analysis, Design, Development, Implementation, and Evaluation). The ADDIE model was operationalized through five systematic stages (Adri et al., 2020; Basir et al., 2024; Ningrum et al., 2023; Sial, 2024), which are detailed as follows:

1) Analyze

The analysis stage was conducted by identifying the underlying causes of pedagogical challenges through direct observation at SMP Islam Sultan Agung 1 Semarang. These identified issues were subsequently classified to determine effective resolutions, with a particular focus on instructional infrastructure, student needs, and the prevailing curriculum implemented at the school. Furthermore, the data gathered from the field were reduced and synthesized to formulate a strategic pre-planning phase tailored to address the specific problems encountered.

2) Design

The design stage was initiated to ensure that the developed product serves as a viable solution to the pedagogical challenges identified during the analysis phase. This stage encompassed the formulation of research instruments, the development of instructional content, the selection of appropriate resources for product creation, and the drafting of the initial product design. This design process functioned as a critical verification step, as it involved the construction of a product prototype. Subsequently, the product was developed to be evaluated for its validity, practicality, and effectiveness—specifically focusing on the utility of the CTL-based interactive handout in enhancing students' mathematical problem-solving skills.

3) Development

The development stage aimed to materialize the initial designs and validate the resulting product to ensure its suitability for field testing. The validation process for the CTL-based interactive handout determined the functional viability of the medium and identified any necessary refinements. Subsequently, the

interactive handout underwent iterative revisions based on the specialized feedback and corrective suggestions provided by the three subject matter experts.

4) Implementation

The implementation stage involved field-testing the developed product by applying it to the target subjects. Prior to the instructional intervention, a pre-test was administered to assess the students' initial mathematical problem-solving proficiency before utilizing the CTL-based interactive handout. Subsequently, the learning process was conducted by integrating the interactive handout, which was strategically developed based on the Contextual Teaching and Learning (CTL) approach.

5) Evaluation

The evaluation stage was conducted to assess the developed product based on the criteria of validity, practicality, and effectiveness in fostering students' mathematical problem-solving skills. The analysis of validity was scrutinized through the design process and the final development outcomes of the CTL-based interactive handout, as evaluated by three expert validators. Practicality was measured during the implementation phase by analyzing teacher and student response questionnaires regarding the utility of the interactive handout. Finally, the level of effectiveness was determined by referring to three key parameters: individual mastery, classical mastery, and N-Gain score analysis.

This developmental research was conducted at SMP Islam Sultan Agung 1 Semarang from mid-to-late May 2024. The research sample comprised 22 seventh-grade students from class VII B at the institution. Data collection techniques included validation sheets for the three expert validators (media, material, and language experts), teacher and student response questionnaires, and mathematical problem-solving ability tests. Specifically, the instruments utilized for the validity test were expert validation sheets, while the practicality test employed response questionnaires. Furthermore, the effectiveness test utilized a set of geometric similarity problem-solving tasks, consisting of both pre-test and post-test instruments. The data were subsequently analyzed using individual mastery assessments, classical mastery criteria, and N-Gain score analysis. The validity

criteria were established using a Likert scale, with the data obtained from the validity analysis presented in Table 1.

Table 1. Validity Test Criteria

Persentage	Validity Criteria
$0\% \leq x < 20\%$	Invalid
$20\% \leq x < 40\%$	Low Validity
$40\% \leq x < 60\%$	Moderately Valid
$60\% \leq x < 80\%$	Valid
$80\% \leq x \leq 100\%$	Highly Valid

The criteria for determining practicality, established via a Likert scale and obtained through the practicality data analysis, are outlined as follows:

Table 2. Practicality Test Criteria

Score	Criteria
$P>81\%$	Highly Practical
$61<P\leq81\%$	Practical
$41\%<P\leq61\%$	Moderately Practical
$21\%<P\leq41\%$	Impractical

The mastery of mathematics learning regarding geometric similarity among the seventh-grade students in class VII B at SMP Islam Sultan Agung 1 Semarang was determined using individual mastery benchmarks. Within the development of this CTL-based interactive handout, students were required to satisfy the school's Minimum Mastery Criterion (KKM), which was established at 70. Furthermore, classical mastery was evaluated based on the percentage of collective learning success, stipulating that at least 75% of the total students in the classroom must achieve scores meeting or exceeding the KKM threshold. Following the administration of the normalized gain (N-gain) test, the criteria for learning outcome improvement were scrutinized based on the following classification:

Table 3. Criteria for Learning Outcome Improvement

Normalized Gain Value (g)	Criteria
$g \leq 0,3$	Low
$0,3 < g \leq 0,7$	Medium
$g > 0,7$	High
$g = 0,00$	No Improvement
$-1,00 \leq g < 0,00$	Decrease

RESULT AND DISCUSSION

During the analysis phase, field observations were conducted at SMP Islam Sultan Agung 1 Semarang to gather initial data required for product development. The diagnostic results revealed several critical findings: first, instructional practices remained predominantly conventional, leading to widespread student passivity and off-task behaviors during lessons. Second, classroom learning infrastructure was suboptimal, as learning resources were strictly limited to textbooks accessible only during designated instructional hours. Third, there was a noticeable deficiency in the pedagogical integration of technology by students. Lastly, from a cognitive standpoint, students encountered substantial difficulties in translating contextual problems into formal mathematical equations and articulating precise conclusions. These compounded challenges necessitated a strategic intervention, leading to the formulation of a preliminary plan to design a CTL-based interactive handout aimed at bolstering students' mathematical problem-solving skills.

Following the identification of the pedagogical challenges encountered in class VII B at SMP Islam Sultan Agung 1 Semarang during the analysis phase, the study proceeded to the design stage. This phase aimed to conceptualize and verify the initial structural framework of the product, which would subsequently serve as the definitive prototype. Through this systematic modeling, the previously diagnosed issues could be addressed with targeted design solutions. The operational procedures carried out during this design phase encompassed the following steps:

a. Research Instruments.

Research instruments were utilized to evaluate the viability, validity, practicality, and effectiveness of the developed CTL-based interactive handout. Specifically, validation sheets administered to media, material, and language experts were employed to objectively determine the structural and conceptual validity of the final product.

b. Selection of Learning Resources.

The selection of instructional materials was tailored to align with student needs, the specified pedagogical approach, and indicators designed to enhance students' mathematical problem-solving skills. Initially, the process involved compiling the primary subject matter to be presented in the interactive handout, followed by gathering extensive theoretical and empirical references regarding the CTL framework to be systematically integrated with the selected mathematical content.

c. Product Design Development.

The structural blueprint of the interactive handout was designed in strict accordance with conventional handout development guidelines, spanning from the front cover to the back cover. The content architecture of this interactive medium was meticulously aligned with the prevailing curriculum and executed utilizing the Canva application. This platform was selected because it provides a diverse array of aesthetically engaging templates suitable for educational material design, thereby serving as a robust alternative for constructing modern instructional media (Maharani et al., 2022).

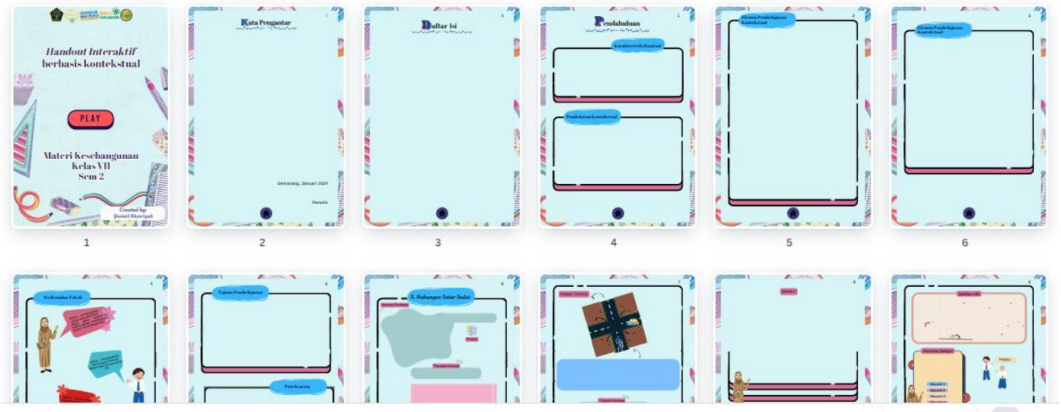

Figure 1. Initial Design

The instructional content within the developed interactive handout was supplemented with explicit explanations of the utilized CTL framework. This addition was deliberately integrated to ensure that students do not merely follow the learning phases mechanically, but profoundly comprehend the pedagogical meaning and purpose underlying each stage. Furthermore, context-rich instructional videos were designed using the Canva platform. These multimedia components were subsequently downloaded, archived in Google Drive, and systematically linked to the predefined interactive features embedded within the handout layout.

To cultivate a comprehensive Contextual Teaching and Learning (CTL) environment, interactive quizzes were structurally integrated into the handout layout utilizing the Quizizz platform, while student reflection activities were systematically constructed via Liveworksheets. The design phase executed through Canva culminated in the absolute finalization of all primary and supplementary structural components, including the front cover, table of contents, core learning materials, glossary, reference list, author biography, and precise page numbering. Consequently, the comprehensive structural blueprint and the embedded operational features within each instructional tool were fully accomplished and verified.

Subsequently, the PDF design downloaded from Canva was converted into an interactive digital flipbook utilizing the Heyzine platform. Each embedded tool was populated with functional hyperlinks directing students to context-rich instructional videos, interactive quizzes, reflection activities, and word problems focusing on mathematical problem-solving skills. Once all online linkages within these tools were rigorously verified and operational, the final CTL-based interactive handout was fully deployed. The medium was then made accessible to students for instructional deployment through either a distributed web link or a scannable QR code.

The developed product was refined in strict accordance with the evaluation criteria and structural feedback recommended by the media, material, and language experts. The construction of the CTL-based interactive handout was executed

utilizing the Canva platform. Structurally, the interactive handout comprised four primary sections: the pre-introductory pages, the introductory pages, the core content pages, and the concluding pages. The pre-introductory section contained the foreword, table of contents, and specialized icon guidelines explaining the operational function of each embedded tool within the handout. Furthermore, the introductory section of the interactive handout featured the unique characteristics of the medium, the foundational tenets of the Contextual Teaching and Learning (CTL) approach, character introductions, learning objectives, concept maps, and meaningful learning indicators.

The core content pages of the interactive handout featured the primary mathematical subject matter integrated with the essential tenets of the Contextual Teaching and Learning (CTL) approach, namely constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment. Within this section, the instructional materials presented student-centered activities designed to explicitly bridge abstract mathematical concepts with real-world scenarios and daily experiences.

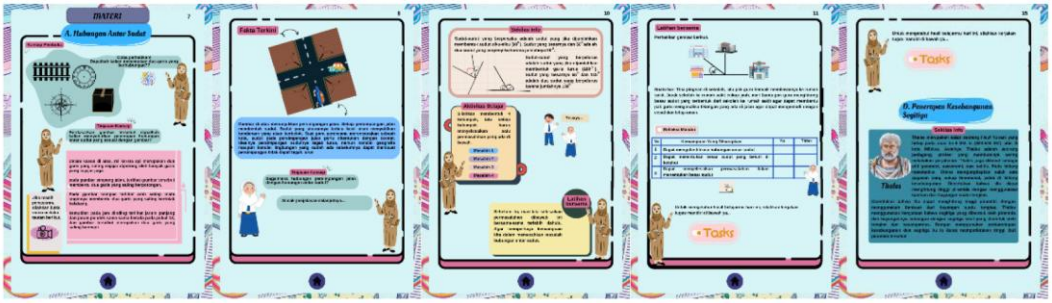

Figure 2. Main Page

The concluding pages of this CTL-based interactive handout comprised a glossary, a reference list, and the author's biography. The glossary provided precise definitions of the technical terms utilized throughout the handout content, aiming to assist students in overcoming potential language barriers and clarifying unfamiliar terminology encountered during the learning process.

The fully developed interactive handout was deployed online and remains accessible via the following hyperlink: https://heyzine.com/flip-book/988f7d5c2b.html. Subsequently, the digital medium underwent formal

evaluation and iterative refinement based on critical feedback from media, material, and language experts. Data collection regarding expert judgements was facilitated through the administration of structured validation questionnaires. Upon incorporating the recommended structural adjustments, the refined interactive handout was deemed fit for instructional field testing among students. Specifically, the media validation process was executed by an expert reviewer to diagnose necessary technical refinements and evaluate the overall pedagogical interface of the CTL-based interactive handout. The quantitative outcomes derived from the media validation questionnaire are delineated below:

Table 4. Media Expert Validation Results

Aspect	Average Score
Technical Requirements	4,8
Total Score Obtained 4,8	
Percentage Score (P) 95,38%	
Validity Category	

The empirical determination of the 'Highly Valid' category from the media expert validation demonstrated that the developed interactive handout successfully satisfied all core technical requirements. This high-level validity indicated that the digital medium incorporated precise typography, appropriate font selection, and an intuitive layout design that effectively optimizes user navigation and enhances students' interaction with the product (Alamsyah & Yusuf, 2025; Fiorella, 2023; Maphosa, 2021). Furthermore, the integration of visual elements and instructional videos was meticulously aligned with the sequential phases of the Contextual Teaching and Learning (CTL) approach. Based on these comprehensive diagnostic outcomes, the media expert concluded that the developed instructional tool possesses robust technical feasibility and is fully viable for classroom implementation. Subsequently, the quantitative data derived from the material expert validation questionnaire are presented in the following table:

Table 5. Material Expert Validation Results

Aspect	Average Score
Didactic Requirements	5
Construction Requirements	5
CTL-Based Interactive Handout	4, 5
Total Score Obtained 14, 5	
Persentage Score 98, 26%	
Validity Category Valid	

The material expert validation instrument encompassed three distinct evaluation dimensions: content appropriateness, presentation quality, and alignment with the Contextual Teaching and Learning (CTL) approach (Basir et al., 2024; Mukhlishin, 2024; Noviyanti & Basir, 2025; Nurjanah & Basir, 2025; Putri & Basir, 2025; Sumarni et al., 2023). These three aspects were systematically structured around the active mathematics curriculum and predefined learning objectives, ensuring that the integration of the CTL approach explicitly fosters the targeted mathematical problem-solving capabilities. The empirical outcomes delineated in the preceding section demonstrated that the developed instructional tool possesses high pedagogical feasibility and is fully viable for educational deployment according to the material experts. This finding strongly aligns with the evaluative principles established by Hatzimanouil et al. (2019), who asserted that developed educational products must rigidly adhere to predefined instructional goals to ensure that the utilization of digital modules remains synchronized with expected learning outcomes.

Table 6. Language Expert Validation Results

Aspect	Average Score
Linguistic Feasibility	4,8
Total Score Obtained 4,8	
Persentage Score 95,56%	
Validity Category Valid	

The language expert validation sheet focused explicitly on the linguistic feasibility dimension, which evaluated four core indicators: straightforwardness, communicativeness, interactivity, and adherence to grammar rules and student developmental levels (Basir et al., 2020). Implementing high-quality and linguistically appropriate discourse within educational products ensures that

students can navigate instructions seamlessly and integrate them effectively into the learning process. The empirical evaluation completed by the language expert resulted in a 'Highly Valid' category, confirming that the digital medium possesses excellent readability and is fully viable for subsequent classroom deployment.

Following its categorization as 'Highly Valid' by the three expert validators and the subsequent incorporation of their structural recommendations, the finalized interactive handout was transitioned into the implementation phase. This digital medium was field-tested across three consecutive instructional sessions involving seventh-grade students (Class VII B) at SMP Islam Sultan Agung 1 Semarang. Empirical observations indicated that the students' mathematical problem-solving capabilities exhibited a progressive enhancement during each sequential meeting, which consistently utilized identical learning phases aligned with the Contextual Teaching and Learning (CTL) approach. By the third session, the substantial majority of the classroom cohort successfully resolved the mathematical tasks in strict compliance with the four established problem-solving indicators. This longitudinal trend strongly comports with the evaluative findings of Buchori (2019), who similarly posited that a minimum threshold of three structured instructional interventions is required for students to definitively internalize and solve complex mathematical non-routine problems.

The data analysis regarding the practicality of the developed CTL-based interactive handout was derived from the evaluative feedback provided by both the teacher and students following the instructional deployment of the product. Within this investigation, the mathematics teacher at SMP Islam Sultan Agung 1 Semarang administered the teacher response questionnaire, while 28 seventh-grade students from class VII B at the same institution completed the student response questionnaires to assess the operational feasibility of the learning medium.

Table 7. Teacher Response Questionnaire Results

Evaluation Aspect	Average Score	Percentage (P)	Practicality Category
Interface Design and Layout	4.75	95.00%	Highly Practical
Content and Material Presentation	4	80.00%	Practical
Instructional Benefits and Implementation Feasibility	4	80.00%	Practical
Pedagogical Application of the CTL Approach	4.75	95.00%	Highly Practical
Overall Average Cumulative	4.38	87.50%	Highly Practical

The empirical outcomes derived from the student response questionnaires demonstrated that the developed CTL-based interactive handout achieved the 'Highly Practical' classification. This robust result firmly established that the instructional medium possesses high operational feasibility and is fully viable for integration into classroom learning processes.

Table 8. Student Response Questionnaire Results

Evaluation Aspect	Average Score	Percentage (P)	Practicality Category
Content and Material Presentation	4.78	95.60%	Highly Practical
Interface Design and Layout	4.56	91.20%	Highly Practical
Utilization Benefits	4.67	93.40%	Highly Practical
Implementation Feasibility	4.77	95.40%	Highly Practical
Overall Average Cumulative	4.7	94.40%	Highly Practical

The data analysis regarding the effectiveness of the developed CTL-based interactive handout was determined based on the pretest and posttest scores of 28 seventh-grade students in class VII B at SMP Islam Sultan Agung 1 Semarang. The effectiveness level of this instructional medium was evaluated through both individual and classical learning mastery benchmarks. Individual mastery was measured by the students' ability to achieve the Minimum Mastery Criterion (KKM) established by the institution, which was designated at 70 for the mathematics discipline. The empirical outcomes of the individual mastery assessment via the posttest demonstrated that the seventh-grade cohort achieved a high average mathematical problem-solving score of 86.89. Consequently, these findings

indicated that student learning outcomes following the instructional intervention with the developed CTL-based interactive handout successfully satisfied and exceeded the prescribed KKM threshold.

Classical mastery was evaluated based on the collective learning success rate within the classroom, stipulating that at least 75% of the total enrolled students must successfully achieve scores meeting or exceeding the Minimum Mastery Criterion (KKM). At SMP Islam Sultan Agung 1 Semarang, the KKM threshold for the mathematics discipline was established at 70. The empirical findings demonstrated that the seventh-grade students in class VII B not only satisfied individual mastery benchmarks regarding geometric similarity but also successfully reached a high classical mastery rate of 89% following the instructional integration of the CTL-based interactive handout. Consequently, this substantial percentage confirmed that the developed digital medium effectively fosters widespread academic achievement and ensures equitable learning success across the classroom cohort.

The empirical analysis of the normalized gain (N-gain) test demonstrated that the classroom cohort achieved an overall mean score of 0.7067. Falling precisely within the statistical interval of $g > 0.7$, these quantitative outcomes indicated that the improvement in mathematical problem-solving capabilities among the seventh-grade students in class VII B at SMP Islam Sultan Agung 1 Semarang was classified under the 'High' category. Implementing modernized and innovative instructional media, such as the developed digital interactive handout, significantly scaffolds mathematics learning, particularly in bolstering students' strategic mathematical problem-solving skills (Amini, 2017; Basir & Aminudin, 2020).

Evaluation procedures were systematically executed at each analytical phase to determine the validity, practicality, and effectiveness of the developed product. The validity analysis was comprehensively evaluated based on the quantitative and qualitative feedback derived from the media, material, and language expert validation sheets. Furthermore, the practicality analysis was assessed through the operational implementation of the CTL-based interactive

handout, utilizing the data gathered from the teacher and student response questionnaires administered immediately following the instructional deployment of the learning medium. Lastly, the effectiveness analysis was rigorously scrutinized through the administration of pretest and posttest instruments, which were executed prior to and after the completion of the learning sessions utilizing the newly developed CTL-based interactive handout.

CONCLUSION

The empirical evaluations regarding the developed CTL-based interactive handout demonstrated outstanding outcomes across all specified research parameters. The product validation by media, material, and language experts yielded 'Highly Valid' classifications, with definitive validity scores of 95.38%, 98.26%, and 95.56%, respectively. Concurrently, the practicality assessment based on teacher and student evaluative feedback positioned the medium within the 'Highly Practical' category, securing robust ratings of 87.50% and 94.40%, respectively. Furthermore, the effectiveness analysis executed through the student pretest and posttest scores at SMP Islam Sultan Agung 1 Semarang revealed a significant quantitative increase in the classroom mean score from 59.04 to 86.89, successfully satisfying both individual and classical learning mastery criteria. Consequently, these consolidated findings firmly establish that the developed CTL-based interactive handout possesses high pedagogical and technical feasibility, rendering it fully viable and effective for integration into mathematics instruction to significantly foster students' mathematical problem-solving capabilities.

Based on the empirical insights gained from this investigation, several recommendations are posited for future research endeavors. First, subsequent researchers are encouraged to maximize the integration of open-ended essay quizzes and incorporate additional interactive digital applications to further scaffold students' mathematical problem-solving capabilities. Second, the development of similar Contextual Teaching and Learning (CTL)-based interactive handouts should be expanded to encompass other mathematics curricula, thereby fostering more accessible and versatile instructional environments. Lastly, future studies are

expected to design and deploy CTL-oriented digital media that target a broader spectrum of higher-order thinking skills (HOTS), expanding the instructional focus beyond mathematical problem-solving competencies alone.

REFERENCES

Adri, M., Sri Wahyuni, T., Zakir, S., & Jama, J. (2020). Using ADDIE Instructional Model to Design Blended Project-Based Learning based on Production Approach Blende Project-Based Learning Based on Production Approach on Software Engineering Course View project Micro-Learning Project on Entrepreneurship. *International Journal of Advanced Science and Technology*, *29*(06), 1899–1909. https://www.researchgate.net/publication/341178504

Akmal, A. U., Yohandri, & Razak, A. (2023). Profile of Students ' 21 st Century Skills in Digital Learning Using The Contextual Teaching and Learning (CTL) Model. *International Journal of Elementary Education*, *7*(4), 731–741. https://doi.org/https://doi.org/10.23887/ijee.v7i4.66570

Alamsyah, N., & Yusuf, D. U. (2025). Pengembangan Media Pembelajaran Interaktif Berbasis PowerPoint pada Mata Pelajaran Dasar Desain Grafis di SMK Negeri Kota Makassar. *Education and Information Technologies*, *1*(1), 22–28. https://jurnal.aaapublisher.com/index.php/EIT

Amini, R. (2017). The Development of Integrated Learning Based Students' Book to Improve Elementary School Students' Competence. *Unnes Science Edication Journal*, *6*(2), 1586–1592.

Basir, M. A., Agustyani, M., & Maharani, H. R. (2024). Innovative Trigonometry Learning : The Role of Liveworksheets-assisted Interactive Worksheets in Improving Numerical Literacy. *Mosharafa: Jurnal Pendidikan Matematika*, *13*(3), 605–620. https://doi.org/https://doi.org/10.31980/mosharafa.v13i3.2366

Basir, M. A., Alif Hazira, K. V., & Kusmaryono, I. (2020). Pengembangan Media Islamic Math Comics Dalam Meningkatkan Pemahaman Matematis Dan Karakter Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *9*(3), 842. https://doi.org/10.24127/ajpm.v9i3.2539

Basir, M. A., & Aminudin, M. (2020). Pengembangan Buku Teks Matematika berbasis Investigasi untuk Meningkatkan Penalaran Aljabar. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, *4*(1), 53. https://doi.org/10.31331/medivesveteran.v4i1.1016

Basir, M. A., & Maharani, H. R. (2018). Cognitive load in working memory on trigonometry Learning. *Unnes Journal of Mathematics Education*, *7*(2), 85–89. https://doi.org/10.15294/ujme.v7i2.25366

Buchori, A. (2019). Pengembangan Multimedia Interaktif dengan Pendekatan Kontekstual untuk Meningkatkan Pemecahan Masalah Kemampuan

Matematika. *Jurnal Inovasi Teknologi Pendidikan*, *6*(1), 104–115. https://doi.org/http://dx.doi.org/10.21831/jitp.v6.1.20094

Fiorella, L. (2023). Making Sense of Generative Learning. In *Educational Psychology Review* (Vol. 35, Issue 2). Springer US. https://doi.org/10.1007/s10648-023-09769-7

Hatzimanouil, D., Natsis, K., Lazaridis, S., Giannakos, A., Hantau, C., Giatsis, G., & Sikaras, E. (2019). Interactive E-Module Model Of Transformation Geometry Based On CASE (Creative, Active, Systematic, Effective) As A Practical And Effective Media To Support Learning Autonomy And Competence. *Brazilian Journal of Implantology and Health Sciences*, *2*(2), 25–32. https://doi.org/https://doi.org/10.36557/2674-8169.2019v1n7p206-223

Heru. (2018). Pengembangan Multimedia Game Pembelajaran Matematika SMP. *Jurnal Math Educator Nusantara*, *4*(1), 1–14. https://doi.org/doi.org/10.29407/jmen.v4i01.12003

Kalyani, L. K. (2024). The Role of Technology in Education : Enhancing Learning Outcomes and 21 st Century Skills. *International Journal of Scientific Research in Modern Science and Technology*, *3*(4), 5–10. https://doi.org/https://doi.org/10.59828/ijsrmst.v3i4.199

Maharani, H. R., Ubaidah, N., Basir, M. A., Wijayanti, D., Kusmaryono, I., & Aminudin, M. (2022). Pengembangan Profesionalisme Guru Melalui Pelatihan Komik Digital dengan Canva for Education. *Dinamisia : Jurnal Pengabdian Kepada Masyarakat*, *6*(3), 760–768. https://doi.org/10.31849/dinamisia.v6i3.10084

Mallika, A. I. (2024). The Influence of the Contextual Teaching and Learning (CTL) Model on Improving Critical Thinking Skills in Mathematics among Junior High School Students. *Journal of Education Innovation and Curriculum Development*, *02*(02), 41–48. https://journals.iarn.or.id/index.php/educur/index

Maphosa, V. (2021). Teachers' Perspectives on Remote-based Teaching and Learning in the COVID-19 Era: Rethinking Technology Availability and Suitability in Zimbabwe. *European Journal of Interactive Multimedia and Education*, *2*(1), e02105. https://doi.org/10.30935/ejimed/9684

Maritsa, A., Salsabila, U. H., Wafiq, M., Anindya, P. R., & Ma'shum, M. A. (2021). Pengaruh Teknologi dalam Dunia Pendidikan. *Al-Mutharahah: Jurnal Penelitian Dan Kajian Sosial Keagamaan*, *18*(2), 91–100. https://doi.org/10.46781/al-mutharahah.v18i2.303

Maulidia, M., Dwi, A., & El, B. (2025). Peningkatan Keaktifan Siswa Melalui Model Pembelajaran Contextual Teaching and Learning (CTL). *ENTITA: Jurnal Pendidikan Ilmu Pengetahuan Sosial Dan Ilmu-Ilmu Sosial*, *ial Editio*. https://doi.org/https://doi.org/10.19105/ejpis.v1i.19167

Mukhlishin, H. (2024). Development of Teaching Materials Based on Contextual Teaching Learning (CTL) in Physical Chemistry Courses. *Journal of Research in Science Education*, *10*(6), 3316–3324. https://doi.org/10.29303/jppipa.v10i6.6960

Ningrum, N. L., Basir, M. A., & Maharani, H. R. (2023). Pengembangan Komik Digital untuk Meningkatkan Literasi Numerasi Siswa Materi Statistika. *Jurnal Pendidikan Matematika*, *9*(2), 164–171.

Noviyanti, D., & Basir, M. A. (2025). Development of similarity module based on ethnomathematics of Troso Jepara fabric motifs to improve numeracy literacy. *UNION: Jurnal Ilmiah Pendidikan Matematika*, *13*(2), 455–470. https://doi.org/10.30738/union.v13i2.19605

Nurjanah, S., & Basir, M. A. (2025). *Desain dan Implementasi Alat Peraga KOPSINU dalam Pembelajaran Make a Match : Dampaknya Terhadap Literasi Numerasi*. *5*, 92–104.

Putri, A., & Basir, M. A. (2025). Design Of A Similarity Module Based on Problem-Based Learning With Osing House Ethnomatematics Of Banyuwangi To Improve Students' Numeracy Literacy. *Jurnal Pembelajaran Dan Matematika Sigma (JMPS)*, *11*(1), 133–141.

Rachmawati, F. K., Diah, N., Lestari, S., & Oktavianingtyas, E. (2024). Profil Literasi Numerasi Siswa SMA dalam Menyelesaikan Soal AKM Konten Aljabar Berdasarkan Kemampuan Matematika. *Jurnal Ilmiah Pendidikan Matematika*, *12*(2), 294–309. https://doi.org/10.25273/jipm.v12i2.18983

Riza, S., Rizki, D., Aidi, M., & Ihsan, N. (2024). The Effect of The Use of Contextual Teaching and Learning (CTL) Learning Model on The Cognitive Value of Students of Elementary School. *Journal of Research in Science Education*, *10*(5), 2702–2710. https://doi.org/10.29303/jppipa.v10i5.6988

Rohmah, A. N., Sutama, S., Hidayati, Y. M., Fauziati, E., & Rahmawati, L. E. (2022). Planning for Cultivation Numerical Literacy in Mathematics Learning for Minimum Competency Assessment (AKM) in Elementary Schools. *Mimbar Sekolah Dasar*, *9*(3), 503–516. https://doi.org/10.53400/mimbar-sd.v9i3.51774

Saputra, H., Utami, L. F., & Purwanti, R. D. (2023). Era Baru Pembelajaran Matematika : Menyongsong Society 5 . 0. *Indiktika : Jurnal Inovasi Pendidikan Matematika*, *5*(2), 146–159. https://doi.org/10.31851/indiktika.v5i2.11155

Sial, Z. A. (2024). Addie Model of Instructional Effectiveness : Analyzing The Impact On Students Learning. *Journal of Law Social Studies*, *6*(1), 64–72. https://doi.org/10.52279/jlss.06.01.6472

Sumarni, S., Prayitno, A. T., Syafari, R., Basir, M. A., Febrianti, D., & Putri, A. (2023). Instrumen Tes Kemampuan Literasi Numerasi Berbasis Budaya Lokal Kabupaten Kuningan Jawa Barat. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1), 789.

https://doi.org/10.24127/ajpm.v12i1.6439

Tohara, A. J. T. (2021). Exploring Digital Literacy Strategies for Students with Special Educational Needs in the Digital Age. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, *12*(9), 3345–3358. https://doi.org/10.17762/turcomat.v12i9.5741

Ukobizaba, F., Nizeyimana, G., & Mukuka, A. (2021). Assessment Strategies for Enhancing Students ' Mathematical Problem-solving Skills : A Review of Literature. *EURASIA Journal of Mathematics, Science and Technology Education*, *17*(3). https://doi.org/https://doi.org/10.29333/ejmste/9728

Umar, Hasratuddin, & Surya, E. (2022). Pengembangan LKPD Berbasis Model Think Aloud Pair Problem Solving Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa SD Negeri 067248 Medan. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *06*(03), 3402–3416. https://doi.org/https://doi.org/10.31004/cendekia.v6i3.1884

Winata, A., Seftia, I., Widiyanti, R., & Cacik, S. (2021). Analisis Kemampuan Numerasi dalam Pengembangan Soal Asesmen Kemampuan Minimal pada Siswa Kelas XI SMA untuk Menyelesaikan Permasalahan Science. *Jurnal Educatio*, *7*(2), 498–508. https://doi.org/10.31949/educatio.v7i2.1090