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Development of a Website for Solving Mathematical Problems to Enhance Vocational High School Students' Motivation

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ABSTRACT

This study aims to enhance mathematics learning outcomes by developing a problem-solving learning website to motivate students on sequences and series material at SMK Ksatrian Purwokerto. The research method employs an R&D approach using the ADDIE model and purposive sampling. Samples were drawn from Class XI TKJ 3 as the control group and Class XI TKJ 5 as the experimental group (website). The problem-solving strategy utilized Polya's steps. Hypothesis testing was conducted using an independent t-test to analyze mean differences, with the One-Sample Kolmogorov-Smirnov test for normality as a prerequisite. Results indicate that the data met assumptions of normality and homogeneity, and the implementation of the website-based problem-solving approach significantly improved students' cognitive scores and learning motivation on sequences and series material compared to the control group. Correlation analysis reveals a positive influence between problem-solving ability and learning motivation.

Keywords: ADDIE; Cognitive; Problem solving; Polya; Website

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1. INTRODUCTION

Students are expected to master the subject matter and possess critical thinking skills, creative problem-solving abilities, collaborative communication skills, and the capacity to take the initiative in various social, professional, digital information, and educational contexts (Widiasanti et al., 2023). Mathematics education in Era 5.0 has emerged as a response to the rapid technological advancements of the 21st century and societal demands for high-quality education. Industry 4.0 has transformed all aspects of life into digital domains (Javaid et al., 2024; Yaqub & Alsabban, 2023). Learning in vocational high schools employs an industry-based curriculum. The industry-based vocational high school curriculum for Computer Engineering and Networking (TKJ) expertise competency is designed based on the link and match principle by synchronizing the curriculum structure with business and industrial world competency standards (DU/DI). Mathematics learning in vocational high schools (SMK) is characterized by its abstract and monotonous nature, primarily delivered through conventional lecture methods (Darmawan et al., 2019), particularly in topics such as algebra, sequences and series, and statistics. Furthermore, instructional materials fail to integrate with vocational fields—such as applications of mathematics in automotive engineering, graphic design, telecommunications, and computer networking—resulting in students' difficulty comprehending concepts and low academic performance (Di Pietro & Castaño Muñoz, 2025). Many students perceive mathematics as an intimidating and challenging subject to understand (Du et al., 2025). This perception induces tension during classroom instruction, thereby discouraging many learners from posing inquiries, articulating viewpoints, or engaging actively in the pedagogical process (Darling-Hammond et al., 2020). Consequently, elevated levels of mathematical anxiety lead to disaffection with the subject, culminating in diminished conceptual understanding (Aini et al., 2024). This phenomenon contributes to diminished student learning motivation, as mathematics is perceived as a burdensome subject, ultimately fostering despair and disengagement toward the discipline.

The main problems faced by students at SMK Kesatrian Purwokerto are low learning motivation, cognitive aspects of learning motivation, and computational skills. Students demonstrate low interest and perseverance in mathematics lessons, impacting their inadequate numerical abilities. This results in numerical competency achievement scores that fail to meet the standards and potentially hinder

students' mathematics skill grades. Cognitive aspects—including attention, working memory, cognitive flexibility, and metacognition—form the primary foundation for effective problem solving .

Mathematical problem-solving ability mediates the relationship between affective factors, such as student anxiety, mathematical reasoning, and learning motivation. Problem-solving is a cognitive process that involves the use of linguistic information, problem identification, application of problem-solving strategies, and goal achievement based on identified information (Alivana & Masriyah, 2025; Amalina et al., 2026; Estiningrum et al., 2019; Lubis & Rangkuti, 2024; Vula et al., 2017). Mathematical problem-solving engages cognitive, metacognitive, affective, and cognitive flexibility interactions, from understanding the problem and representing situations to selecting strategies, monitoring, and evaluating solutions, contingent upon students' reasoning abilities, spatial processing, learning memory, and attention (Kholid et al., 2025; Rini et al., 2021). The self-regulation process in mathematical problem-solving using Polya's method comprises four stages (Polya, 1978). The indicators of problem-solving steps consist of four phases: understanding the problem, devising a plan, carrying out the plan, and looking back (Haqiqiyah & Putri, 2025; Polya, 1978; Riyadi et al., 2021). Factors influencing students' learning motivation include deficiencies in arithmetic and geometry computation abilities, such as determining the nth term or sum of sequences. A prime example is students' difficulties with arithmetic sequence problems and applying the formula $a_n=a+(n-1)b$ for arithmetic series and geometric ratios (Schlimm, 2026). Computer and networking majors in vocational high schools (SMK) find it difficult to understand the concept of sequences and series (Adiastuty et al., 2025; Mucti & Hermansyah, 2023; Rifai et al., 2025; Sari et al., 2022) and geometric series networks (Amsari et al., 2022). Low cognitive abilities among SMK students manifest in basic operations and abstract modeling. This leads to students' inability to comprehend studied problems and unachieved academic outcomes (Heriyana et al., 2025). Furthermore, to enhance the quality and learning outcomes of SMK students, website-based learning technology is employed.

Websites for mathematics learning serve as instructional media that deliver visual mathematics content, exercises, and interactive activities. Web-based mathematics learning visualization, encompassing text, images, videos, and quizzes offers accessibility at any time to enhance students' conceptual understanding, mathematical literacy, and learning competencies (Irmawan et al., 2022; Loor et al., 2024). Web-based learning (WBL), also known as e-learning (electronic learning), constitutes the application of internet technology in educational processes. WBL involves the utilization of internet technology, with learning processes actively engaged by students (Fauziah, 2020; Puspitasari et al., 2018). Websites represent multimedia documents (text, images, audio, animations, videos) accessed via the HTTP (Hypertext Transfer Protocol) using browser software (Bishop, 2020; Perna et al., 2022).

Previous research indicates that website-based learning in vocational high school (SMK) mathematics negatively impacts students' cognitive attitudes, including motivation, self-efficacy, and abstract concept comprehension (Chiu, 2023). This results in students experiencing concentration difficulties, limited teacher interaction, and unstable internet connectivity. Developmental research on E-modules in vocational SMK for linear equation material reveals shortcomings. Deficiencies in smartphone-based E-modules for mathematics learning include students' lack of focus due to small screen displays and slow loading times, along with limited samples (Sumandya & Mahendra, 2020). Utilization of the interactive QuizWhizzer medium in mathematics classrooms proves less effective, as it causes student fatigue during online sessions (Saputra & Subekti, 2024).

Previous studies on developing mathematics websites for vocational secondary school (SMK) students have highlighted negative outcomes, such as poorly designed, non-intuitive user interfaces, content lacking relevance to vocational disciplines, and insufficient long-term assessments of motivation improvement. These flaws have intensified mathematics learning difficulties in SMK contexts, where learners struggle to relate abstract topics like algebra, sequences and series, and statistics to real-world technical or business applications (Yanti & Bayu, 2022). The present research overcomes these limitations through the adoption of an intuitive user-centered design, Industry 4.0-aligned content (e.g., IoT-integrated simulations for sequence and series calculations in telecommunications engineering) (Cimino et al., 2025), and real-time analytics capabilities to track and elevate SMK students' learning motivation. Beyond affirming the platform's intrinsic interactivity, this

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approach empirically confirms the enduring capacity of web-based technologies to counteract student disengagement and underachievement (Rotar, 2025). The novelty of this research lies in demonstrating that students can enhance mathematical learning motivation and cognitive achievement through website-based.

2. RESEARCH METHOD

This research employs a quantitative approach utilizing a descriptive quantitative research design. It further adopts a research and development (R&D) method The development procedure utilizes the ADDIE model, consisting of five systematic stages:

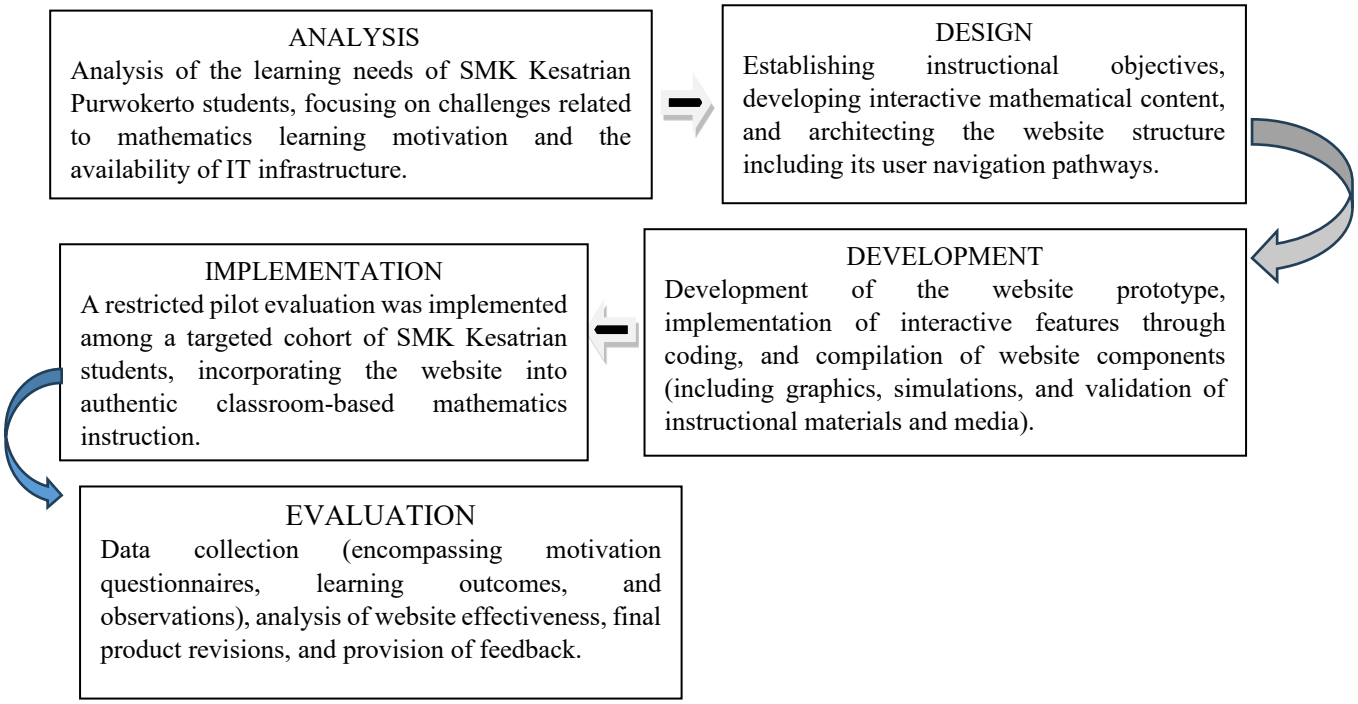


Fig. 1. Diagram of ADDIE Procedures

This research aims to enhance students' learning outcomes by developing a website-based instructional and mathematical problem-solving medium to boost student motivation on sequences and series material, contextualized for vocational high school (SMK) students, focusing on numerical sequences and series. To preserve the natural classroom environment, purposeful sampling was employed. This non-probability technique enables researchers to select volunteers based on characteristics pertinent to the study. Research subjects comprised Class XI students majoring in Computer and Network Engineering at SMK Ksatrian Purwokerto. The study was conducted across two Class X Computer and Network Engineering (TKJ) classes during the odd semester of the 2025/2026 academic year: the experimental class and the control class. Class X TKJ 1 served as the experimental group, utilizing Polya's problem-solving strategy alongside the website intervention, whereas Class X TKJ 2 functioned as the conventional control group without the Polya method. Data for this study were collected from Class XI TKJ 3(control) and XI TKJ 5 Industry class (Experiment website) at SMK Ksatrian Purwokerto. The experimental class comprised 30 students. The data collected consisted of posttest results on arithmetic and geometric sequences and series material. The following table presents posttest results from both experimental and control classes.

Teachers and students fill out the practicality questionnaires. The percentages derived from their responses are computed and subsequently classified in accordance with established practicality criteria.

Data collection techniques involved administering treatments to both the experimental and control classes. Upon completion of instruction, a final written essay posttest was administered. Prior to implementation, the instrument underwent validation by the mathematics teacher and supervising

lecturer to ensure data validity for research purposes. The following outlines the sequential steps employed in this study: (1) Conducting school observations and interviews with the mathematics teacher. (2) Developing instructional materials, specifically the lesson plan (RPP) and test specifications. (3) Preparing teaching materials on arithmetic and geometric sequences and series. (4) Implementing instruction with Polya's problem-solving steps plus website intervention in the experimental class, versus conventional learning without Polya steps in the control class. (5) Administering a conventional posttest in both experimental and control classes. (6) Conducting observations and interviews to gather qualitative data on students' experiences, impressions, responses, encountered obstacles, and perceived benefits. (7) Processing and analyzing research data. (8) Compiling the research findings report.

Hypothesis testing in this research employed an independent samples t-test to analyze mean differences. Prior to t-test analysis, normality testing utilized the Kolmogorov-Smirnov test. Normality testing determined whether student learning outcomes followed normal distribution, followed by homogeneity testing to ascertain whether both samples exhibited equivalent variances.

3. RESULTS AND DISCUSSION

The ADDIE method stages in developing a mathematics problem-solving learning website proved systematic and effective: analysis identified student needs and competency gaps in sequences and series topics; design formulated learning objectives, problem scenarios, and interactive module structures; development produced multimedia content, guided exercises aligned with Polya's steps, and real-time feedback features; implementation involved field trials in the experimental class to ensure applicability and accessibility; and evaluation employed quantitative and qualitative instruments to assess cognitive improvements and motivation. Empirically, the ADDIE application yielded structured and adaptive materials that facilitate student problem-solving, reduce cognitive load, enhance conceptual mastery, and boost motivation and learning outcomes in sequences and series material.

A. Analysis Stage

This research phase systematically investigated challenges at SMK Ksatrian Purwokerto, focusing on curriculum analysis and comprehensive needs assessment. Curriculum analysis aims to ensure e-module alignment with the implemented curriculum (Azamfirei et al., 2025; Karakuş, 2021). This process involves identifying syllabus-tailored development materials and analyzing student characteristics through syllabus review (Tan et al., 2025; Wotring & Chen, 2021).

Observation and interview results reveal that sequences and series instruction in Class XI Computer and Network Engineering (TKJ) remains dominated by lectures and routine exercises, hindering connections between sequence/series concepts and vocational contexts. Observations and interviews with Class XI mathematics teachers revealed that learning processes continue to rely primarily on textbooks as the main resource, with minimal utilization of electronic learning media. Instruction predominantly employs lecture-based methods. Furthermore, students face difficulties comprehending course content, particularly sequences and series concepts. They exhibit confusion in applying formulas for both arithmetic sequences and arithmetic series. (Ario et al., 2025) notes that students struggle to select appropriate formulas for problem-solving, as they cannot distinguish between arithmetic and geometric sequences, resulting in frequent errors in question responses. This enables students to independently explore connections between sequence/series concepts and computer networking components (Haleem et al., 2022). The website is developed as a responsive application accessible via smartphones and personal computers, allowing students to learn anytime, anywhere.

B. Design Stage

During this phase, the website "Mathematical Sequences and Series in Computer Network Engineering Components" was developed, featuring structured content that covers fundamental sequence and series concepts as well as their practical applications in computer network component design. Each activity targets the development of problem-solving and learning motivation indicators as outlined in the research proposal. The four problem-solving indicators used are understanding the problem, devising a solution plan, implementing the plan, and reviewing the solution. Key factors influencing student motivation include intrinsic motivation, extrinsic motivation, perseverance and

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discipline, as well as interest and engagement in learning. The design follows a problem-solving website framework with these sequential steps:

Table 1. Problem-solving stages

Stage	Explanation of Problem Solving
Understand the problem	Students solve contextual problems on sequences and series in computer networking, identifying the problem and understanding sequence/series concepts.
Planning the completion	Students devise strategies or steps for the given problem, including selecting appropriate sequence/series formulas.
Carrying out the plan	Students implement the devised solution, executing the formulated steps to achieve resolution.
Looking back	Students evaluate results by reviewing solution effectiveness and accuracy, making necessary revisions.

The developed website product comprises several sections: an initial section (login menu, homepage, references, and contact us); content management section (course creation and management, teaching management, material upload and management, quiz creation and management, review of student submissions and registration); and evaluation section (exercises, tests, and problem-solving activities). At the module's conclusion, supporting components include a glossary, references, and module developer information. The problem-solving website development is planned with integrated material serving as the primary foundation. Evaluation instrument design includes analysis and trial worksheets integrated with student answer sheet photo uploads to the website. All components are systematically arranged in a storyboard to ensure logical and sequential material delivery. This material management enhancement aims to foster students' cognitive work in problem-solving and increased motivation, optimizing mastery of learned knowledge (Ninnuan & Montree, 2022).

C. Development Stage

This stage entails implementing the product design and evaluating its feasibility through validity assessment. The website is accessible via personal computers, laptops, desktops, and smartphones. The following presents the website's cover and menu interface:

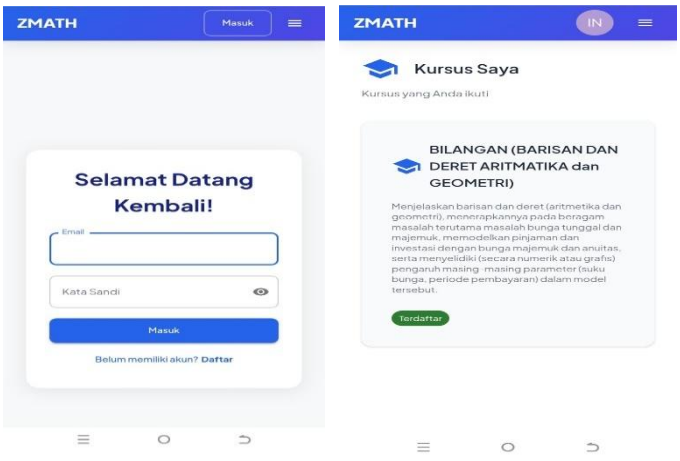


Fig. 2. Display on a smartphone

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Consistent with (Daryanes et al., 2023) research, this development stage encompasses activities to realize the previously created product design. The objective is to produce a revised draft of the instructional materials based on expert feedback, enabling subsequent testing. The website pages demonstrate responsive design and user-centered interface principles

.



Fig. 3. Student's my courses menu display

Figures 1 and 2 illustrate interactive learning content with clear navigation and interaction systems. The website offers various visual schematics to aid users and is optimized for smartphones, tablets, and other mobile devices to enable flexible learning. User testing confirms its compatibility with smartphones, validates usability, and yields positive feedback on interactivity, accessibility, and responsiveness. Content integrates YouTube videos and PDF formats. The "My Courses" menu facilitates problem-solving skill development within computer networking contexts, sustaining student confidence across challenges (Mahapoonyanont et al., 2010)

D. Implementation Stage

The website was implemented with Class XI students specializing in Computer Network Engineering at SMK Kesatrian Purwokerto using a posttest-only control group design. One class was designated as the experimental group utilizing the website, while the other served as the control group receiving conventional instruction. Both classes followed identical problem-based learning (PBL) models, with the control class excluding website media integration.

This study comprised two primary groups: a control group and an experimental group, each consisting of 30 students. The control group (n=30) served as a non-intervention comparator, whereas the experimental group (n=30) received a targeted treatment to assess the independent variable's efficacy. Equal sample sizes across groups ensured balanced representation and minimized bias in comparative outcome analyses.

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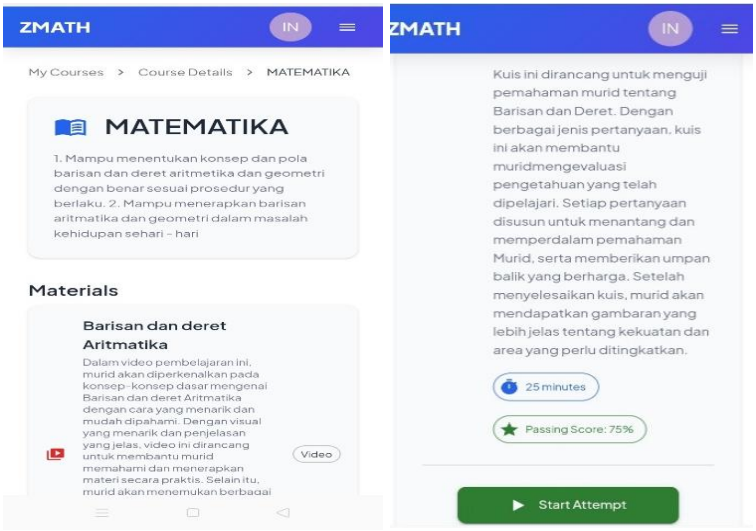


Fig. 4. Student website design

Before instruction commencement, teachers in the experimental class received training on utilizing the website and its supporting tools. Subsequently, students underwent website training. Student activities on the website formed part of a systematic scaffolding process designed to enhance mastery through successful learning experiences. During the initial session, students were introduced to the website menus, material access procedures, and navigation to the "My Courses" section.

Students engaged in problem identification and data detection activities. For data detective tasks, they completed case study simulations of computer network component design. Students received basic computation instructions to validate component positioning using arithmetic and geometric sequence formulas. At this stage, they were guided to comprehend data and build confidence through successful mastery of contextual mathematical concepts (Abdulrahaman et al., 2020). During the second session, the design critique focused on analytical attributes, encouraging students to provide data-based arguments that substantially reinforced their technical confidence.

Following instructions, students completed a written test that measured cognitive performance through a problem-solving quiz consisting of four questions, each assessing one indicator: understanding the problem, planning the solution, implementing the plan, and reviewing the outcome. Subsequently, students responded to user response questionnaires and motivation surveys. Selected students were then interviewed to deepen the qualitative findings.

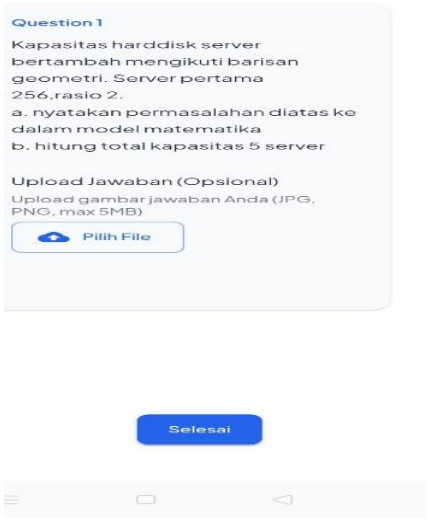


Fig. 5. Student Quiz Design Image

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E. Evaluation Stage

The purpose of this evaluation is to determine whether the developed website can enhance students' mathematical conceptual understanding in the material of arithmetic sequences and series. The final stage of this research involves reviewing website quality based on expert validation and practitioner questionnaires to determine necessary modifications. If required, the website undergoes revision to produce optimal learning media. The website is deemed practically ready if the media assessment falls within "practical" or "highly practical" categories. Results measuring student website usage practicality levels are presented in detail in Table 3.

The final stage also assesses website quality through expert validation and feasibility questionnaires to ascertain modification needs. Revisions ensure optimal learning media production. The website is considered feasible and ready if the media evaluation falls within "good" or "very good" categories. The results of the feasibility measurement for student website usage are detailed in Table 2.

Table 2. Website Feasibility Results for Problem Solving

No	Assessment Aspects	Percentage	Category
1	Clarity	75%	Good
2	Ease of use	92%	Very Good
3	Display quality	80%	Good
4	Navigasi	75%	Good
5	Program management	85%	Good
Average (Persentage))		**82%**	**Very** Good

The average feasibility test results for website-based mathematics problem-solving validity achieved "Very good" status. The highest validity score for learning problem-solving was ease of use (92%), enabling students to access and study the material directly and effortlessly. This correlates with website display quality validation scores deemed feasible by experts. Furthermore, website-based mathematics instruction benefits from clear sequences and series material presentation, adequate navigation, and highly feasible program management, ensuring optimal problem-solving website functionality for classroom mathematics instruction. Problem-solving as an intervention to enhance individual student learning motivation can be quantitatively analyzed using the independent samples t-test to compare mean differences between the experimental and control groups.

The validation results for website interface aspects—namely content clarity, ease of use, display quality, navigation, and program management—demonstrate a strong correlation with enhanced student cognitive problem-solving in learning mathematical sequences and series at vocational high schools (SMKs). The material is presented clearly, concisely, and in a structured manner. Students grasp abstract concepts such as general terms and partial sums more rapidly, thereby making analytical and deductive thinking processes more effective. The intuitive ease of use and navigation reduce cognitive load related to technical tools, allowing students to focus on mathematical problem-solving strategies and meticulously evaluate solutions (AlShaikh et al., 2024; Surbakti et al., 2024). High display quality (including graphical visualizations, neat mathematical notation, and interactive examples) facilitates mental representations of sequence and series concepts, strengthening knowledge transfer from symbolic to conceptual understanding (González-Campos et al., 2022; Mary Osei Fokuo et al., 2023). Furthermore, effective program management, such as module sequencing, automated feedback, and progress tracking, supports scaffolded and personalized learning, which can boost students' confidence and learning motivation.

Table 3. Research Data on Problem-Solving Skills

No	Grade Information	Control Class	Experimental Class
1	Minimum	54	72
2	Maximum	88	96
3	Average	76	82
4	standard deviation	9,8	5,5

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Table 1. Shows that the average learning outcome of students taught using Polya's step-by-step problem-solving strategy, which is 96, is better than the average learning outcome of students taught without using Polya's problem-solving strategy, which is 88. The mean problem-solving ability score for students in the experimental class was 82, exceeding the control class mean of 76. Additionally, the experimental class standard deviation (5.5) was lower than that of the control class (9.8), indicating greater uniformity in critical thinking abilities among experimental students. Therefore, the data demonstrate that the Mathematics Problem-Solving Website more effectively enhances student motivation compared to conventional instruction.

Hypothesis testing requires prerequisite examinations for final comparison of both groups. The One-Sample Kolmogorov-Smirnov Test yielded significance values of 0.200, both exceeding the 0.05 threshold. Therefore, the data exhibit normal distribution. The following presents the SPSS computation results: One-sample Kolmogorov-Smirnov normality testing revealed that data on the mathematics problem-solving website usage adhered to a normal distribution ($p = 0.200 > 0.05$). This satisfied the normality assumption for subsequent analyses, thereby enabling evaluation of the website-based mathematics learning intervention's impact on student motivation and academic outcomes. Utilizing the website for sequences and series mathematics proves effective as a learning tool (Akın, 2022). Website-based mathematics learning enhances student learning motivation, potentially yielding improved conceptual understanding and elevated academic performance (Nafiah et al., 2022; Tong et al., 2022).

The homogeneity test examined whether variances between experimental and control groups were equivalent, yielding a significance value of 0.516. Since this significance value exceeds 0.05, variances for both classes are declared homogeneous. The following presents the SPSS computation results:

Test of Homogeneity of Variances

Motivation

Levene Statistic	df1	df2	Sig.
.426	1	58	.516

Fig. 6. Results of normality test calculations

The results of the data analysis show that students' cognitive scores and enthusiasm to learn were significantly improved by using math problem-solving websites. The efficiency of instructional instruments is reflected in a normal data distribution, which is confirmed by normality testing with p-values greater than 0.05. The homogeneity of variance test p-value of 0.516, on the other hand, shows steady variation in student motivation and suggests that everyone benefits equally from using the website. Incorporating technology into math lessons promotes interactive problem-solving and builds stimulating learning settings that raise student interest. Pupils were more motivated to learn mathematics and take on challenges, which eventually helped them perform better academically (Lishchynska et al., 2023; Wheeler, & Cabigas, 2024). Web-based tool integration in math education offers flexible, adaptive methods that encourage self-directed learning while preserving the essential support for cognitive growth (Muhammad et al., 2025).

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Motivasi	Equal variances assumed	.426	.516	5.506	58	.000	6.767	1.229	4.306	9.227
	Equal variances not assumed			5.506	57.347	.000	6.767	1.229	4.306	9.227

Fig. 7. Results of hypothesis test calculations

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Independent samples t-test analysis reveals significant differences between experimental and control classes in mathematics learning on sequences and series material. The significance value (Sig. 2-tailed) of 0.000 (< 0.05) indicates that website-based learning through problem-solving approaches substantially enhances student abilities. The calculated t-value of 5.506 with a mean difference of 6.767 demonstrates superior achievement in the experimental class compared to the control group.

These findings suggest that systematic problem-solving steps (understanding the problem, planning solutions, implementing plans, and evaluating outcomes) integrated within website-based media foster more structured and analytical student thinking. This approach elevates cognitive abilities as students progress beyond mere memorization of sequence/series concepts to practical problem-solving applications.

Website-based instruction delivers more interactive and engaging learning experiences, thereby enhancing student motivation. Elevated motivation directly contributes to improved learning outcomes through increased student activity, engagement, and interest in solving assigned problems (Andrić et al., 2026; Singh et al., 2022).

Hypothesis testing outcomes demonstrate significant differences between experimental and control classes. These results confirm web-based learning effectiveness in enhancing students' cognitive abilities, motivation, and academic performance. Validation was conducted by experts assessing material content, instructional design, language clarity, visual presentation, and website functionality. Validation results categorized as "valid" or "highly valid" affirm that the developed website meets feasibility standards as instructional media while optimally supporting problem-solving processes.

Website-based mathematics instruction validity encompasses multiple stages. The first stage presents contextual problems. Subsequent stages involve the Polya method application for problem formulation, strategy development, implementation, and evaluation—logically aligned with sequences and series material characteristics (Chacón-Castro et al., 2023; Gopinath & Lertlit, 2017). Furthermore, validation of visual appeal, interactivity, and usability aspects creates engaging learning experiences that enhance SMK student motivation and learning outcomes.

Correlations

		CO	EK
CO	Pearson Correlation	1	.490**
	Sig. (2-tailed)		.006
	N	30	30
EK	Pearson Correlation	.490**	1
	Sig. (2-tailed)	.006	
	N	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Fig. 8. Correlation test results

Correlation analysis in the experimental class yielded a correlation coefficient of 0.490 with a significance value (Sig. 2-tailed) of 0.006 (< 0.01). This demonstrates a positive and significant relationship between problem-solving scores (variable X) and learning motivation scores (variable Y). The correlation coefficient of 0.490 falls within the moderate category. Higher student problem-solving abilities correspond with increased learning motivation.

Scientifically, this relationship occurs because problem-solving abilities in mathematics instruction on sequences and series require students to navigate systematic thinking stages: understanding problems, planning strategies, implementing solutions, and evaluating outcomes. Successful execution generates achievement experiences that enhance student confidence and learning satisfaction. These conditions directly elevate learning motivation.

The correlation analysis results indicate that problem-solving in learning sequences and series through the website platform exhibits a positive and significant relationship with students' cognitive scores, as well as motivation dimensions and learning outcomes (W. Li et al., 2023). Scientifically, this

positive correlation suggests that increased intensity and quality of student engagement in web-based problem-solving activities (e.g., interactive exercises, visualizations of sequence terms and series sums, and real-time feedback) (S. Li et al., 2025)is associated with elevated cognitive scores reflecting conceptual mastery, reasoning ability, and procedural skills (Sajidin, 2026; Wang et al., 2026). Furthermore, website-based interventions are consistently linked to enhanced intrinsic motivation including self-confidence, learning interest, and perseverance which in turn mediates positive effects on final learning outcomes for sequence and series topics. These findings align with cognitive and motivational learning theories, which posit that interactive and structured learning tools reduce cognitive load, strengthen mental representations of concepts, and boost self-efficacy, thereby empirically improving academic performance (De Witte et al., 2026; Gkintoni et al., 2025).

4. CONCLUSION

The research results indicate the integration of Polya's strategy into website-based learning is effective in enhancing students' motivation to learn about sequences and series, while also improving their cognitive achievements and problem-solving skills. This is demonstrated by the higher average learning outcomes in the experimental class compared to the control class, namely 96 versus 88, with a standard deviation of 5.5 in the experimental class and 9.8 in the control class, indicating that the distribution of learning outcomes in the experimental class is more homogeneous. Since the standard score of the experimental class is lower than that of the control class, the distribution of data in the control class is more homogeneous than in the experimental class.

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