

Website Cerdas Innovation to Optimize Learning Efficiency Through Accommodating Differentiated Learning Styles in Class XII

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Abstract

Time efficiency in learning is crucial, as limited time contrasts with the vast scope of knowledge. The main issue in Class XII IPS 3 at SMAN 1 Pagak lies in the diversity of students' learning styles, which is not supported by adequate instructional time. Teachers are often forced to generalize their teaching methods, increasing the risk of learning loss. The topic of Nusantara decorative patterns was selected due to the class's lowest average scores and continued reliance on conventional media without integration of the TPACK (Technological Pedagogical and Content Knowledge) framework. In the context of 21st-century technological advancement and the importance of Social-Emotional Learning (SEL), education is demanded to be inclusive and adaptive to diverse learning styles. This study develops an innovative learning media, Website Cerdas, which detects and adjusts content according to students' learning styles (visual, auditory, kinesthetic), aiming to enhance efficiency, flexibility, and learning quality. A mixed-method approach was used with the 4D development model (define, design, develop, disseminate). Data were collected through observation, interviews, questionnaires, and pretest-posttest evaluations, analyzed using the Likert scale and N-Gain effectiveness. Validation results from media experts scored 86.6% and from material experts 87.5% (both highly feasible). Small group trials showed 84.8% (highly feasible), and large group trials yielded an N-Gain of 0.755 (highly effective). These findings demonstrate that Website Cerdas is effective in improving students' understanding of decorative pattern materials.

Keywords: Media Development, Time Efficiency, Website Cerdas, Differentiation, Learning Style.

Introduction

Time efficiency is a crucial factor in the learning process, because the faster students understand the material, the more topics they can learn. Addition, students have time to focus on developing the competencies they are interested in. In the case of fine arts learning that focuses on the knowledge of the Ragam Hias Merdeka Curriculum's in class XII IPS 3 SMAN 1 Pagak, students experience difficulties in understanding the material. This obstacle arises due to the different learning styles of each student, where some understand more easily through verbal explanations, while others need visuals such as pictures or videos, and some can only understand optimally through direct practice. Learning styles has

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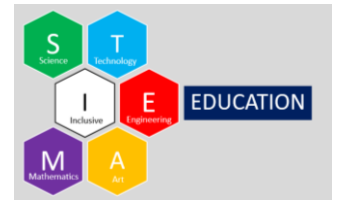
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been defined as the way individuals learn, it relates to the conditions under which individuals concentrate, absorb, process and retain new information and skills, namely how individuals integrate with learning conditions (including cognitive, affective, physical, and environmental aspects) that can facilitate the learning process (Ferrer-Valdivia et al., 2025). Time constraints often lead teachers to generalize learning styles by predominantly using the lecture method. While practical, this approach assumes uniformity in students' learning preferences, disregarding the needs of those who learn better through visual or kinesthetic means. As a result, such students are at risk of missing out on the full understanding of the material. Thus, the learning process by ignoring differences in learning styles actually makes students experience *learning loss* (Kriswanto & Fauzi, 2023). As a result, students face difficulties in achieving the end of semester target, which is the practice of making decorative carvings. In addition, the average fine arts score of class XII IPS 3 is the lowest compared to other classes, even though the number of students in the class is relatively smaller than the other classes in the same batch. The regulation in allowing students to bring smartphones to school and the internet facilities provided, do not always support the learning process. Instead, the easy access to information and entertainment through these devices often disrupts students' focus (Purwaningtyas et al., 2024). As a result, students' concentration diminishes, attention is easily distracted, and social interaction with teachers and peers decreases. Mistakes in smartphone use can foster individualistic behavior, reduce literacy and discussion among students, thus having a negative impact on their learning outcomes. To improve learning outcomes effectively, the use of learning media and methods that suit the needs of students' learning styles is very important (Simbolon & Harahap, 2022). The rapid advancement of 21st-century technology, alongside the growing emphasis on Social-Emotional Learning (SEL), demands an educational system that can inclusively and adaptively accommodate diverse student learning styles. However, field observations conducted on September 9, 2024, revealed that classroom instruction in Grade XII remains predominantly reliant on conventional teaching media, which fail to optimally support visual, auditory, and kinesthetic learning preferences. In response to this challenge, an innovative intelligent website has been developed to identify and adapt learning content based on students' individual learning styles. This innovation aims to enhance the efficiency, flexibility, and overall quality of the learning process by providing personalized instructional pathways aligned with each learner's cognitive and sensory needs. According to Prasetyo (2024), media is needed to convey material that is difficult to understand only through text. In addition, students in class XII have not

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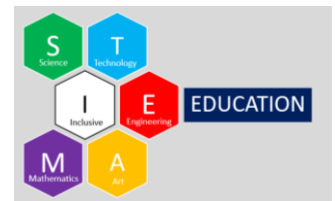
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received media-based learning optimally in accordance with the principles of TPACK (Technological Pedagogical and Content Knowledge).

Learning media designed according to TPACK principles have been shown to have a significant impact on improving student learning outcomes (Batool et al., 2025). This is achieved by facilitating students' understanding through an interactive approach that integrates various forms of media according to their learning preferences. Complex material becomes easier to understand if it is delivered according to students' learning styles (Götzfried et al., 2024). In addition, technology allows students to learn anytime and anywhere with flexibility of time and place (Sugiarto et al., 2023). Therefore, this research develops Website-based learning media to accommodate learning style differentiation that can be accessed from anywhere. The name "Website Cerdas" is taken from its automatic feature that is able to randomize and calculate questionnaire results, then direct students to materials according to their learning style. Website Cerdas media is categorized as interactive multimedia because it integrates text, images, animation, video, and audio (Nugroho, 2016). Research (Pratiwi et al., 2022), shows that the integration of digital multimedia in learning can attract students' interest and make it easier for them to understand the material complex. This website enables teachers to present the concept of ornamental design in an engaging and interactive manner through various multimedia formats. It leverages personal devices and classroom Wi-Fi, allowing students to access learning materials anytime with internet connectivity. Content aligned with the Merdeka Curriculum is provided in auditory, visual, and kinesthetic formats to meet diverse learning needs. This website is also equipped with fourteen quiz items specifically designed to identify the differentiation of students' learning styles, namely visual, auditory, and kinesthetic. This quiz refers to an instrument that has been tested by Akhmad Sugianto (2021) and is compiled based on a psychological approach. Each question in this quiz consists of three answer choices, each of which has been categorized according to a particular learning style indicator. "The answer choices are structured to capture students' cognitive and affective tendencies in processing information. Consistent patterns in their responses reveal dominant learning styles, providing valuable insight for educators to develop instructional strategies that align with individual student characteristics. Moreover, the results of this quiz allow the intelligent website to automatically channel each student toward learning materials that suit their preferred learning style, thereby supporting a more personalized and effective learning experience.

Previous research such as that conducted by Ary Purnadi and Herman Dwi Surjono (2016) in the *Journal of Educational Technology Innovation* developed a learning style-based website for learning Physics at

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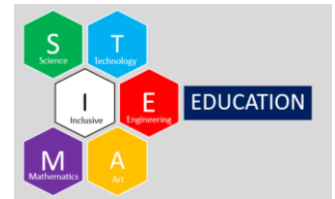
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SMAN 1 Sukamulia. The website provides learning style tests, teaching materials according to preferences, discussion forums, and pretests and posttests. Similar research was also conducted by Ardianti (2022) in the *Journal of Educational Technology* and Isti Nadia et al. (2023) in *Edunomia Journal*. The 'Smart Website' offers the advantage of an automatic feature that independently assesses the questionnaire and directs students to materials suited to their learning style. This media supports the 21st-century education paradigm by fostering 4C skills (critical thinking, communication, creativity, and collaboration) for more efficient and relevant learning (Zubaidah, 2018). Its design, which tailors content delivery to auditory, visual, or kinesthetic preferences, allows students to engage with learning in a manner that best suits their interests. However, the media's limitations arise in schools with inadequate infrastructure, particularly those lacking internet access. Future developments could focus on incorporating real-time data, as current content is limited to preloaded materials.

The development of this instructional media was driven by the researchers' observation that many teachers tend to generalize students' learning styles, often neglecting individual differences in how learners process information. As stated by Yotta (2023), learning style refers to the most effective mode through which a student acquires and internalizes information. In response, this study aims to design and evaluate *Website Cerdas*, an adaptive web-based learning platform tailored to accommodate the diverse learning styles of Grade XII students in the context of studying Nusantara decorative patterns. A mixed-methods research design was employed to ensure both technical rigor and pedagogical relevance. Quantitative methods were utilized for media validation and effectiveness testing through pretest-posttest analysis, while qualitative data were gathered via classroom observations, interviews, and student reflections. This integrative approach provides a holistic assessment of the platform's feasibility and its potential to enhance differentiated instruction in secondary education settings.

Method

The development of a Website Cerdas for the material of the ragam hias in class XII SMAN 1 Pagak uses the 4D research and development (R&D) model by Thiagarajan, which includes four stages of defining (*Define*), designing (*Design*), developing (*Develop*), and disseminating (*Disseminate*) (Thiagarajan 1974, in Winaryati et al., 2021). In practice, the steps of Thiagarajan's 4D Research and Development model are detailed by adjusting field conditions so that later the *Website* is not only pedagogically effective but also functional according to student needs. The following are the stages of the 4D model research that have been adjusted:

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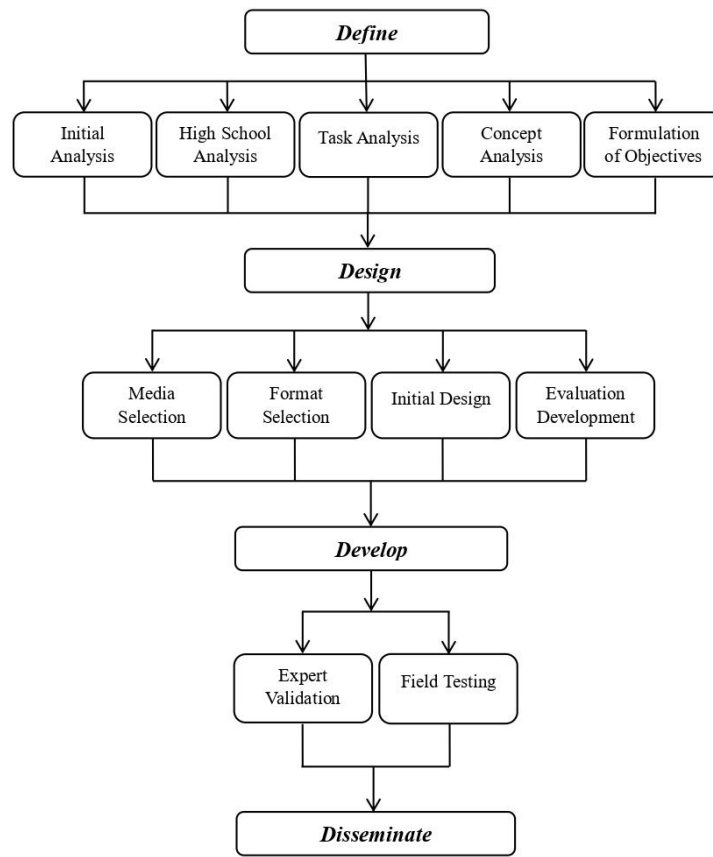
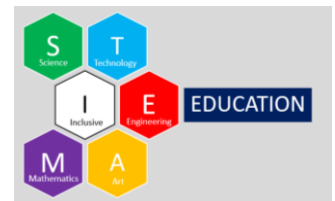


Chart 2.1 Adaptation of the 4D Research and Development Stages by Thiagarajan

Source: Researcher Documents, (2024)

The development of a website-based learning media for ornamental variety materials in Grade XII at SMAN 1 Pagak follows the 4D Research and Development (R&D) model proposed by Thiagarajan, which consists of four stages: Define, Design, Develop, and Disseminate. The Define stage aims to identify learning issues and analyze needs as a basis for selecting, discovering, and determining an appropriate and essential media solution. This stage involves five research steps, including preliminary analysis, high school student analysis, task analysis, concept analysis, and goal formulation. Ultimately, the goal is to integrate an intelligent website as an interactive medium capable of accommodating various learning styles that is auditory, visual, and kinesthetic. The Design stage involves designing appropriate media, selecting a suitable format, creating an initial draft of the intelligent website, and preparing evaluation instruments. The Develop stage involves validation by subject matter and media experts, followed by student trials to evaluate effectiveness through pretests and response questionnaires. Before dissemination, the website must be deemed feasible. During the Disseminate

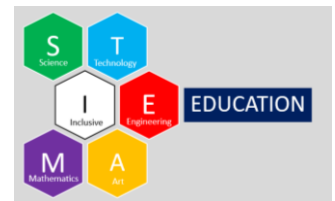
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stage, it is first introduced on a limited scale, and upon positive outcomes, expanded for broader use to support personalized and adaptive learning based on students learning preferences.

The data collected in this study include both quantitative and qualitative types to assess the conceptual feasibility, practical usability, and effectiveness of the developed intelligent website. Quantitative analysis employed a Likert scale to evaluate media quality and user responses. Data from questionnaires, pretests, and posttests were analyzed using descriptive statistics to determine mean scores, percentages, and learning improvement after website implementation. Meanwhile, qualitative data analysis was carried out using an interactive analysis technique comprising three main stages: data reduction, data presentation, and conclusion drawing. Data reduction was performed by selecting essential information from observations and interviews to eliminate irrelevant data. Data presentation was conducted in a narrative descriptive format to facilitate the interpretation of findings. Conclusion drawing involved identifying patterns, relationships, and meanings from the collected qualitative data, providing a deeper understanding of the effectiveness of this website-based learning media.

This development research uses descriptive statistical techniques in analyzing quantitative data. The data analyzed included the results of validation questionnaires from experts as well as student response scores. The calculation process for expert validation and student responses was carried out by applying the data analysis formula based on the theory put forward by (Sugiyono, 2013).

$$P = \frac{\sum \zeta 0}{\sum S \text{ Max}} \times 100\%$$

Keterangan:

P = Average results in percentage form.

$\sum \zeta 0$ = Number of points for all answers.

$\sum S \text{ Max}$ = Maximum number of points from all answers. 100%

100% = Constant

The results of the calculation in the form of an average percentage were analyzed and grouped according to the product feasibility category, which is displayed in the following table:

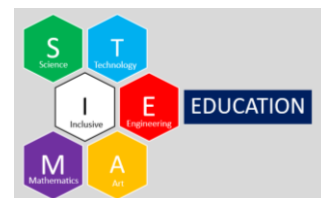
Table 2.1 Validity Test Eligibility Criteria

Validation Level Score	
76% - 100%	Very Feasible
51% - 75%	Worth
26% - 50%	Less Feasible

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0% - 25%

Very Unfit

Source: (Sugiyono, 2013)

Table 2.1 shows the product eligibility criteria according to Sugiyono (2013), which classifies the percentage of results as follows: 0%-25% very inappropriate, 26%-50% less, 51%-75% feasible, and 76%-100% very feasible. The effectiveness of *Website-based* learning media was analyzed using pretest and posttest tests. The test data were processed using the Normalized Gain (N-Gain) formula, which is used to measure the level of improvement in student understanding after using the media.

$$N\text{-gain } (g) = \frac{X_2 - X_1}{X_{\max} - X_1}$$

Description:

X_1 = Pretest Score

X_2 = Posttest Score

$X_{\max}$ = Maximum achievable value

The calculation results in the form of numbers in the range of 0-1 are analyzed and grouped according to the learning media effectiveness criteria, as in the following table:

Table 2.2 Normalized Gain or N-Gain Effectiveness Categories

N-Gain Index	Category
$g < 0,3$	Ineffective
$0,3 \leq g \leq 0,7$	Medium
$0,7 >$	Highly Effective

Table 2.2 presents the effectiveness categories based on the N-Gain index, where scores below 0.3 indicate low effectiveness, scores between 0.3 and 0.7 reflect moderate effectiveness, and scores above 0.7 demonstrate high effectiveness. This classification plays a crucial role in assessing the success of instructional media, providing a clear benchmark for interpreting learning outcomes. It also offers valuable guidance for refining the media to enhance its overall quality and instructional impact.

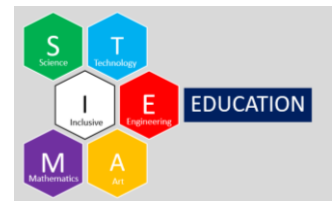
Results

The research findings on the development of the website cerdas media for ornamental variety materials follow the 4D model developed by Thiagarajan, which consists of four stages: Define, Design, Develop, and Disseminate. The following are the results of the website-based learning media development in accordance with the 4D model:

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Define

The Define stage in this research includes five steps to identify the needs and objectives of developing web-based decorative learning media. (1) Initial analysis reveals that the lecture method is still dominant, indicating a need for media that can adapt to diverse student learning styles (Sayed et al., 2025). (2) Student characteristics analysis shows that high school students experience dynamic emotional changes and have a strong interest in technology, making web-based media an effective and engaging learning alternative (Chintya Agung Mulyati & Ria Dewi Eryani, 2022). (3) Task analysis highlights that mastering decorative carving by the end of the semester is the goal, but limited understanding of the material is a major obstacle, which can be addressed through interactive media (Latif et al., 2023). (4) Concept analysis ensures the website caters to various learning styles (auditory, visual, and kinesthetic), enhancing learning effectiveness (Sayed et al., 2025). (5) Goal formulation focuses on creating attractive, interactive, and efficient media to improve student comprehension and assist teachers in delivering material effectively while saving time.

Design

The design stage focuses on developing a conceptual framework for the website, emphasizing the key features that differentiate it from other educational tools. This stage provides a comprehensive overview of the developed product, ensuring clarity in its structure and purpose. Below is a diagram illustrating the flow of media usage within the learning process, offering a visual representation of how the website facilitates student engagement and learning progression:

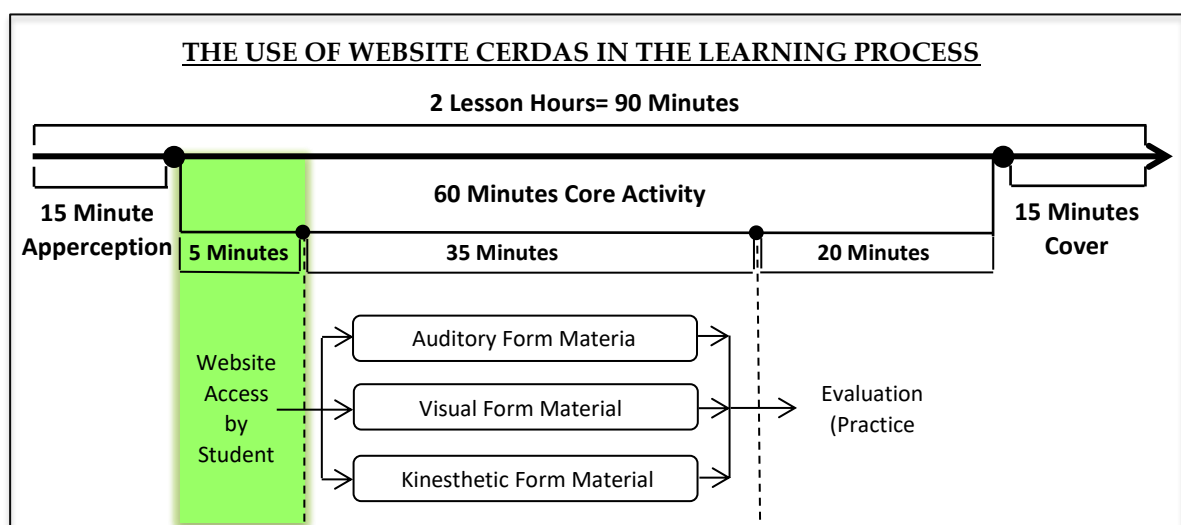
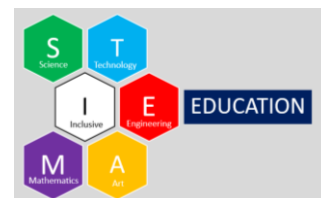


Figure 3.1 Using the 'Website Cerdas' in the Learning Process



Source: Researcher Documents, (2024).

According to the image above, the intelligent website media will be used for 5 minutes after apperception and before the core activity. The design process is divided into four main steps: media selection, format selection, initial design, and evaluation preparation. The first stage **(1) Media Selection** adapts to the needs of XII IPS 3 students who need a more interactive approach by utilizing existing facilities and infrastructure. Based on the results of the analysis at the definition stage, *Website* media was chosen because it has advantages in terms of accessibility and the ability to present complex material that supports a variety of learning styles, such as auditory, visual, and kinesthetic. By using the *Website*, students can access ragam hias material according to the learning style preferences of each student, so that they are expected to learn efficiently in improving understanding and encouraging student activeness in the learning process.

The second stage, **(2) Format Selection** focuses on the needs of the website in the learning process. The use of the *website* as a smart platform equipped with an automatic system of calculating, processing, and accommodating users according to learning styles, is the reason why the website format was chosen in the development of this media. This *website* presents various content formats such as text, image, audio, and video which are adjusted to the students' preferences. With the variety of formats, it is expected to deepen students' understanding, support various learning styles, and increase efficiency in the learning process.

The third stage, **(3) Initial Design**, focuses on making media prototypes. In this design stage, there are two important parts, namely material design and media design. In **(a) designing the material**, researchers compiled teaching tools in the form of learning materials for Unit 2 Grouping Applied Crafts in accordance with the Class XII Fine Arts Teacher's Guide in the Merdeka Curriculum in (2022), especially in the sub-chapter of the archipelago's ragam hias. This material forms the basis for developing website content for Class XII IPS 3 students at SMAN 1 Pagak. The following is the presentation flow of the ragam hias material:

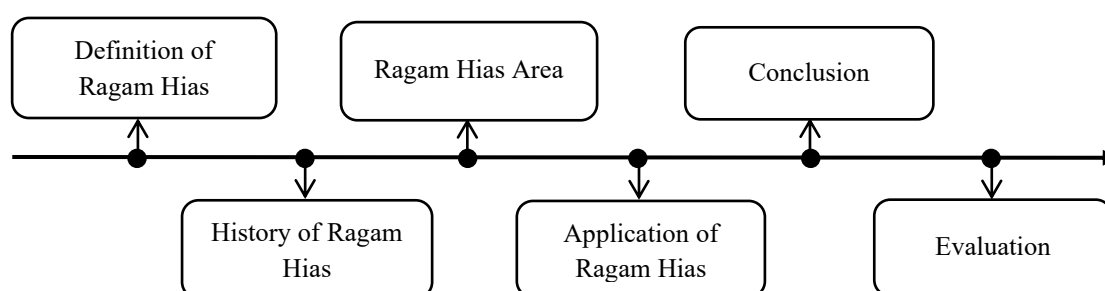


Chart 3.2 Flow of Presentation of Ragam hias Material

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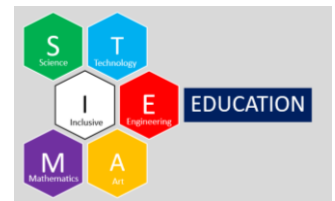
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Source: Personal Documents, (2024)

Figure 3.2 shows the flow of presentation of decorative materials in the learning process. In the understanding section, there is an explanation of the concept of ragam hias in general. The decorative history material describes the origin and development of decorative varieties in Indonesia. In the decorative area section, it explains the decorative areas of the archipelago in Indonesia. , in the application of ornamental variety, it is conveyed how ornamental variety is used in everyday life. Then in the conclusion and evaluation section, there is a link to the *Quizizz* platform that can be used to measure the competence of students' understanding after studying decorative materials using *Website* media.

Then **(b) Media Design**, *Website* design involves HTML, CSS, and JavaScript programming. HTML is used to form the basic structure of the *Website*, such as headings, paragraphs, and image elements. CSS arranges the visual appearance to make it more attractive, including coloring, fonts, and responsive layout. JavaScript adds automation features, such as calculating quiz results and directing students to materials according to learning styles. Once completed, the design was uploaded to hosting for public access. The *website* provides quizzes to sort students' learning styles, which are then directed to relevant learning media.

The fourth stage in the *Design* stage is **(4) Preparation of Evaluation**, carried out through a post-test integrated with Quiz. The purpose of this evaluation is to measure how deeply students understand the material. A total of 20 multiple choice questions designed to motivate students to think critically and increase the spirit of learning. By using Quiz, this evaluation provides an interactive learning experience and encourages students to be more competitive.

Develop

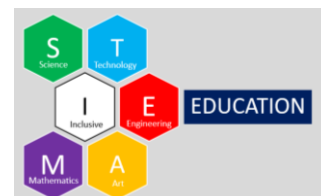
The development stage includes two main steps, namely evaluation by experts and development testing. Expert evaluation aims to confirm the feasibility of product design through evaluation by experts, both in the field of material and media. While media development testing is a stage of product testing on several high school students. There are quantitative and qualitative data in the development results. Quantitative data from filling out the learning media feasibility questionnaire and qualitative data by filling in criticisms and suggestions for product improvement.

(1) The results of the material validation test, conducted by two experts, namely Denik Ristya Rini, S.Pd. M.Pd., a Lecturer in the Fine Arts Education Study Program at the Department of Art and Design, Faculty of Letters, State University of Malang, as material expert I, and Alimah Wijayanti, S.Pd., a Class

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XII Cultural Arts teacher at SMAN 1 Pagak, as material expert II. The validation sheet includes 20 questions that evaluate three aspects, namely material presentation, then material content, and also evaluation. The following is a graph showing the assessment of the two material experts.

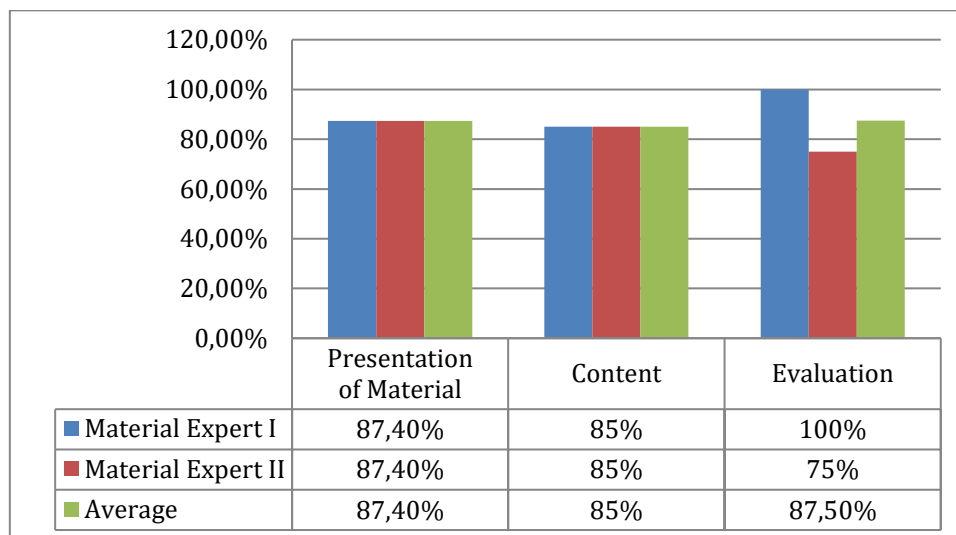


Figure 3.3 Graph of Material Expert Validation Test Result I and II

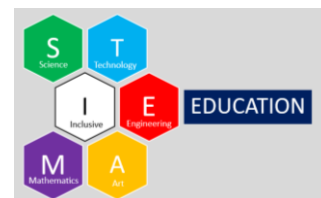
Source: Personal Documents, (2024)

Based on graph 3.3 which shows the results of the material validation test from material experts I and II, the same material presentation aspect is 87.40%, which is classified as "very feasible". The aspect of material content, the same is 85%, which is classified as "very feasible". In the evaluation aspect, getting an average score of 87.5%, also in the "very feasible" category. Thus, it can be concluded that the average score of the combined assessment of the two material experts is 86.6%, which is included in the category of "very feasible". Additionally, qualitative data with critiques and suggestions from material experts is presented in the table below:

Table 3.2: Criticisms and Suggestions of Material Experts I and II

Material Expert I	Material Expert II
Aspect 1 (Presentation of Material)	Aspect 1 (Content)
When open material should be presented clearly every student gets decorative materials in what learning style.	It is recommended to add the region of creation of the archipelago's ornamental variety.

Table 3.2 above are criticisms and suggestions from material expert validators I and II related to the development of decorative materials. According to material validator I in the presentation aspect, adding exposure to clarify each student gets decorative material in what learning style. Meanwhile,



material validator II suggested in the content aspect of the material to add the region of the motif of the creation of the ragam hias of the archipelago. Thus, revisions include affirmation of the title of the decorative material according to the learning style, as well as the addition of the area of creation of decorative patterns.

Media validation was conducted by Abdul Rahman Prasetyo, S.Pd., M.Pd., from Fine Arts Education and Muhammad Nurwiseso Wibisono, S.Kom., M.T., from Visual Communication Design, State University of Malang. The validation sheet consisted of 20 questions that assessed five aspects: media performance, interface design, layout, visuals, and navigation. The following graph shows the average assessment of the two experts:

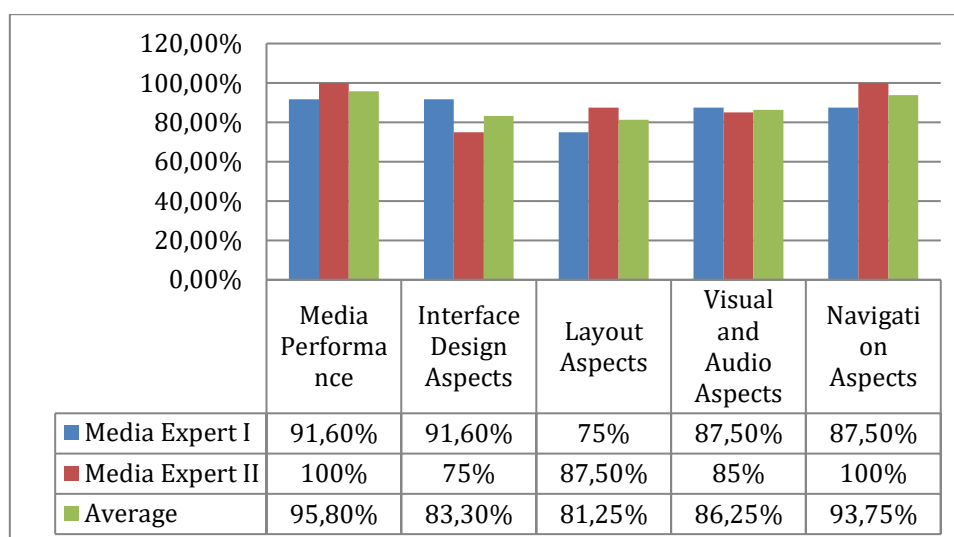


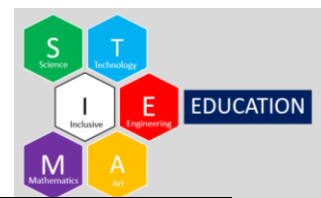
Figure 3.4 Graph of Media Expert Validation Test Results I and II

Source: Personal Documents, (2024)

Figure 3.4 shows the results of the *Website* media validation test by two media experts. In the media performance aspect, the average assessment reached 95.80% (very feasible), the interface design aspect scored 83.30% (very feasible), the layout aspect 81.25% (very feasible), the visual, audio, and audiovisual aspects 86.25% (very feasible), and the navigation aspect 93.75% (very feasible). The overall average assessment is 87.50%, which is classified as very feasible. Qualitative data that includes feedback and suggestions from both experts are also included in the following table:

Table 3.4: Critics and Suggestions of Media Experts I and II

Media Expert I	Media Expert II
Aspect 1 (Media Performance)	Aspect 1 (Media Performance)



Performance for access to <i>Artsteps</i> studio needs to be improved.	Be careful in using the <i>Website</i> media because it requires sufficient bandwidth to access the media, including the <i>Artsteps</i> studio space.
Aspect 2 (Design)	
The interface colors are harmonized to ensure the moving media remains subtle.	Aspect 2 (Interface Design)
	Added logo UM logo as a watermark.
Aspect 3 (Visual, Audio, Audio Visual)	Aspect 3 (Layout)
Using fonts in <i>Website</i> media that are easy to understand and more interesting for high school students.	There is writing that is too small, needs to be corrected.
Aspect 4 (Navigation)	
Clarify the button and its function to avoid confusion.	

Table 3.4 summarizes the criticisms and suggestions from the two media validators. Validator I suggested improving access to the *Artsteps* studio, color consistency, using fonts that are easier to understand, and adding clearer navigation buttons. Validator II highlighted the importance of a stable internet connection, adding a UM logo watermark, and improving text size. The *Website Cerdas* revision, based on assessments from two media experts, includes improving *Artsteps* studio access, adding the UM logo as a watermark, adjusting interface colors, optimizing text size, using clearer fonts, and adding functional buttons.

Furthermore, **(2) Develop Testing Stage**, namely media trials carried out on small groups of students, involving 10 students from 24 students of class XII IPS 3 SMAN 1 Pagak. At this stage, the students were assigned to answer a questionnaire containing their responses to the application of *Website-based* media. The following are the results of data analysis from filling out questionnaires that measure student responses to the use of *Website Cerdas* learning media.

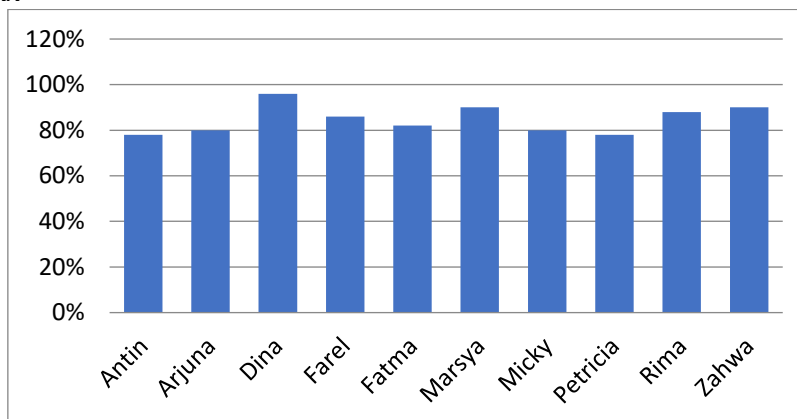
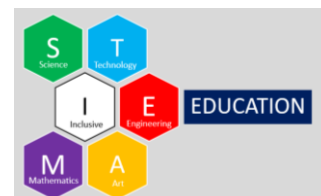


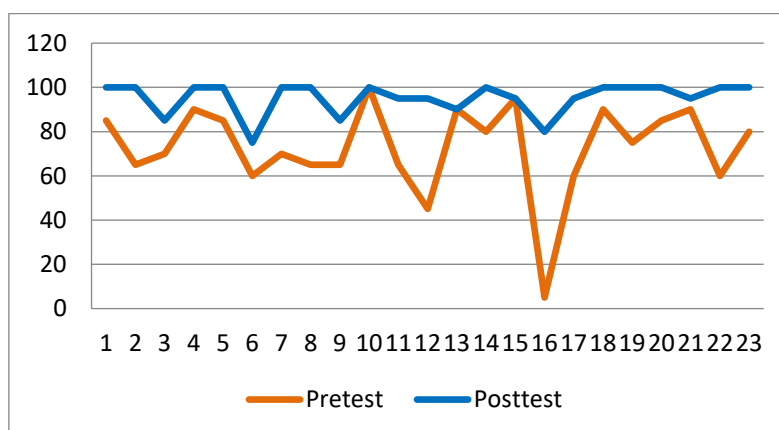
Figure 3.5 Graph of the Results of Completing the Small Trial Student Questionnaire

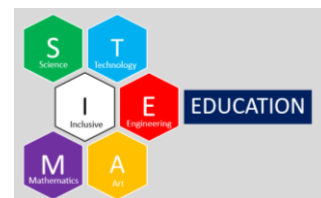
Source: Personal Documents, (2024)

In graph 3.5, the results of the small group assessment show that the average percentage of assessment reached 84.8% (very feasible). With the total total score of the respondents obtained was 424 from 500. Some respondents, such as Dina and Marsya, gave high ratings with percentages of 96% and 90%, reflecting a very positive response to the media. Based on the category, the *Website Cerdas* media is classified as very valid and feasible to be applied in learning.

Disseminate

At the Disseminate stage, evaluations are conducted to measure the effectiveness of the developed product. This research employs a one-class experimental design, where students take a pre-test before using the Website-based learning media and a post-test afterward. This method helps determine whether the website positively or negatively impacts the learning process. The comparison of pre-test and post-test results provides insight into the extent of improvement in students' understanding. The following graph illustrates the differences in scores before and after the implementation of the Website media:

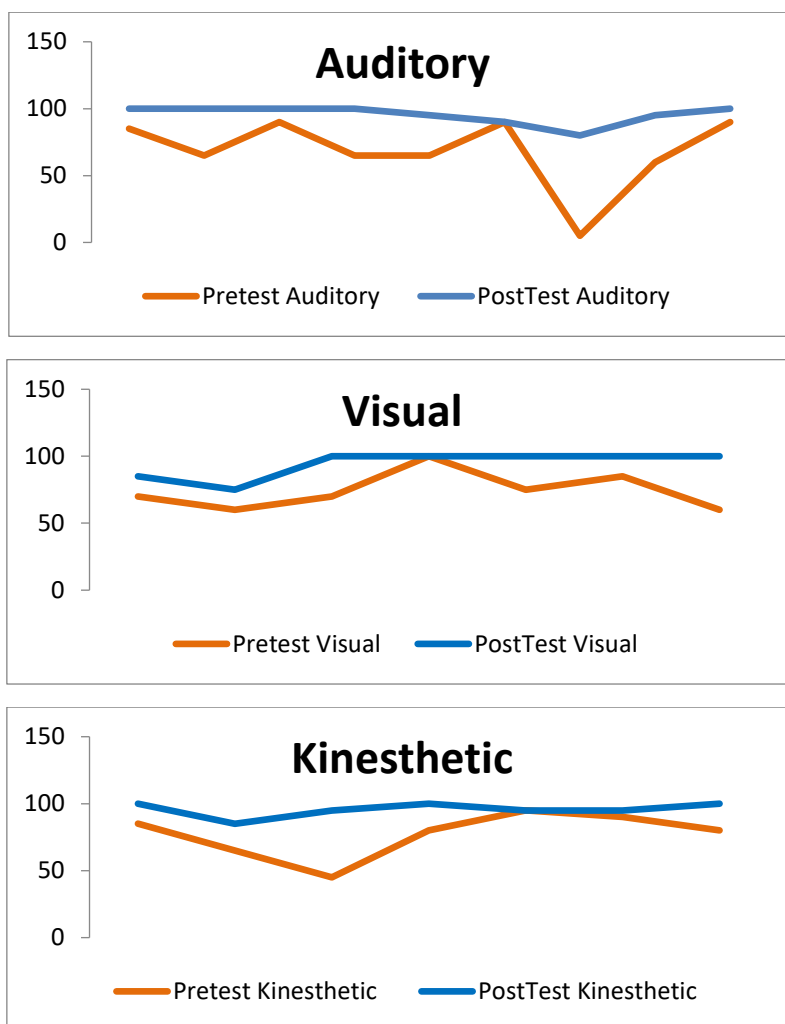




Graph 3.6 Overall Pretest and Posttest assessment results

Source: Personal Documents, (2024)

Graph 3.6 compares pretest and posttest results, showing an initial fluctuation with the lowest pretest score of 5 points due to students' lack of interest in the material and mismatched questions. However, scores increased and stabilized after using the media. The N-Gain analysis results indicate that the Auditory group achieved a score of 0.835 (very effective) for 9 students, the Visual group scored 0.696 (moderate) for 7 students, and the Kinesthetic group scored 0.711 (very effective) for 7 students. This demonstrates that the media effectively enhances students' understanding according to their learning styles. The following graph illustrates the pretest and posttest results for each learning style:



Graph 3.7 Pretest and Posttest Assessment Results for All Learning Styles

Source: Personal Documents, (2024)

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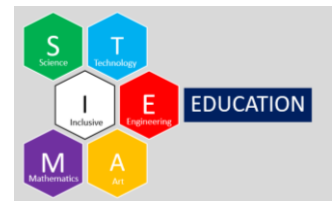


Figure 3.7 shows the increase in each learning style. The calculation of the overall N-Gain average value reached 0.755 which is classified as very effective. This confirms that the application of Website media that only takes 5 minutes in the learning process, with the aim of adjusting the learning style needs of each student has a significant effect on learning outcomes.

Discussion

The development of *Website Cerdas* learning media for decorative materials is intended for class XII students. This *website* is designed to adapt to various learning styles of students in accordance with the concept of TPACK (*Technological Pedagogical and Content Knowledge*), this aims to deepen students' knowledge with efficient time (Charania et al., 2024). The use of this *website* supports an in-depth learning experience, in accordance with the 21st century education paradigm, which includes 4C skills, namely critical thinking, communication, creativity, and collaboration (Zubaidah, 2018). The condition of this paradigm is in line with research (Yuliana & Irawan, 2022), that by implementing 4C Skills can help each learner to achieve optimal potential and develop skills. By utilizing technology, this *website* provides flexibility in terms of accessibility so that students can learn anytime and anywhere (Sugiarto et al., 2023). This *website* combines text, images, audio, and video for efficient and comprehensive access to decorative materials. This *Website Cerdas* is an innovation from the research of Ary Purmadi and Herman Dwi Surjono (2016), Ardianti (2022), and the research of Isti Nadia, Bobi Hidayat, with Sangidatus Sholihah in (2023) who tried to develop learning media products using the *Website*. novelty of the *Website Cerdas* is that it has an automatic system that assesses the results of students' questionnaires and directs them to the material.

It is very efficient in grouping students according to their learning styles, namely auditory, visual, or kinesthetic. Auditory media emphasizes audio elements, such as narration and oral explanations, to help students understand information through hearing. This is in line with research conducted by Pahreza (2021), which shows that students with auditory learning styles more effectively absorb information conveyed verbally because they are more sensitive to sounds and words. Visual media, prioritizes visual elements such as images, videos, graphs, and charts. Visual students tend to understand information presented in visual form more easily, as they focus more on graphic displays (Razilu & Pangestu, 2022). Meanwhile, kinesthetic media emphasizes physical activity and motion in the learning process. Kinesthetic students are more effective at absorbing information when they are engaged in physical activity, as the movement supports comprehension and recall. This finding aligns

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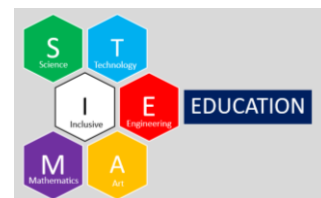
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with the study by Zahid Iqbal & Campbell (2023), which emphasizes that kinesthetic learning involves active physical engagement and learning through hands-on experiences. Thus, the use of media in accordance with students' learning styles can increase the effectiveness of learning.

In accordance with Thiagarajan's elaborated 4D model, the defining stage in this study involved five main steps to develop a *Web-based* learning media for decorative materials. Preliminary analysis revealed that the lecture method at SMAN 1 Pagak was only effective for auditory learning style students, which had an impact on the low fine arts scores in class XII IPS 3. Variations in students' learning styles, such as the need for visual explanations or hands-on practice, hindered their understanding and would tend to be crowded and would also impact students with auditory learning styles. Interviews showed that lectures were less motivating, plus activity distractions such as playing cell phones, as well as emotional fluctuations in students that affected their learning focus (Ayusti, 2022). In addition, a lack of understanding of decorative materials is an obstacle in preparing for the practice of making decorative ornament motifs. Therefore, this *Website* media was developed to adapt the delivery of material to students' learning styles, aiming to improve understanding and increase engagement in learning ornamental variety.

The design process of *Web-based* learning media is conducted through four main stages: the selection of various learning styles of students of class XII IPS 3, namely auditory, visual, and kinesthetic. The media is designed to be flexible and interactive, with several puzzles that can effectively train students' cognitive abilities (Yoosomboon & Wannapiroon, 2015). Media formats include audio, video, images, graphics, animation, and online studio. In the design stage, modules from the Class XII Fine Arts Teacher's Handbook of Merdeka 2022 Curriculum were used as the basis of the material. HTML, CSS, and JavaScript program technologies are applied, including automatic quizzing features to identify students' learning styles. A Quizizz-based post-test is used to assess student understanding and provide immediate feedback. With this approach, the *Website* is expected to increase learning effectiveness and student engagement.

The development stage includes two main procedures, namely evaluation by experts and product testing on students. Expert evaluation involved assessing the feasibility of materials and media, including aspects of presentation, content, and evaluation of materials, as well as performance, interface design, layout, visuals, and media navigation. The results of the validity test showed that the material was very feasible, with some improvements, the addition of regions for the creation of decorative motifs, and the affirmation of material titles according to learning styles. Media testing resulted in a very decent

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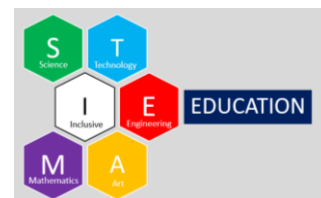
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assessment, with suggestions for improvements such as access to the *Artsteps* studio, fonts that are easier to read, and the addition of a watermark on the logo. Media revision included performance improvement, design, and text .

At the deployment stage, an evaluation was conducted to measure the effectiveness of the product using an experimental design with a pre-test before the use of the media and a post-test afterwards. The results showed an increase in scores from pre-test to post-test. Based on the analysis, the auditory N-Gain score reached 0.835 (highly effective) with 9 students, visual 0.696 (moderate) with 7 students, and kinesthetic 0.711 (highly effective) with 7 students. Before the use of media, this class had the lowest average score even though the teacher had used the lecture method with the majority of auditory learning style students with an N-Gain score of 0.835. After further analysis, it is suspected that students with visual and kinesthetic learning styles tend to be busy when they do not get the form of learning according to their interests, thus disturbing other students with auditory learning styles. Therefore, it makes a causal relationship that distracts students' focus and causes low average scores in class XII IPS 3. The overall N-Gain score is 0.755 which is classified as very effective. So that learning media that is tailored to the learning style of students has a positive impact, in facilitating and increasing the concentration of students in understanding the decorative material.

Conclusions

From this study, it can be concluded that field conditions indicate the absence of technology-based learning media, despite the availability of infrastructure that supports media development in accordance with the TPACK (Technological Pedagogical and Content Knowledge) framework. Furthermore, the technological proficiency of students highlights the urgency of developing an intelligent website-based learning media. The feasibility test results of the Intelligent Website Media show a rating of 86.6% (highly feasible) from subject matter experts and 87.50% (highly feasible) from media experts, while small group trials resulted in 84.8% (highly feasible), confirming that this media is suitable for broader implementation. The website-based learning media, developed using the Research and Development (R&D) approach with the 4D model, successfully accommodates auditory, visual, and kinesthetic learning styles, achieving an overall N-gain score of 0.75, indicating a high level of effectiveness in the learning process. This research contributes to the development of a flexible learning media that facilitates differentiated learning styles, allowing students to engage with materials in ways that best suit their preferences. This personalized approach enhances both comprehension and

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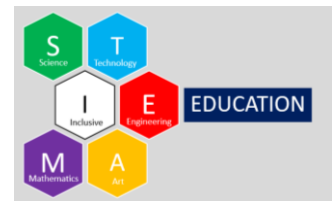
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student engagement in learning. Along with the development of the era and the rapid adoption of technology in the world of education, the use of technology as a tool to sort and accommodate learning style differentiation has become a strategic solution in time efficiency that can be used in the long term to support the learning process. The use of an integrated digital system allows the learning process to be more structured and targeted, because the material can be adjusted to the learning needs of each student. Given that technology has now become an inseparable part of human civilization, the direction of future research is expected to focus on the development of artificial intelligence (AI)-based learning media. This media will be designed to process feedback in real time and dynamically adjust content based on user interactions and responses. This AI-driven learning system will create a more personal, adaptive, and optimal learning experience because it is able to adjust the material to the unique characteristics of each individual.

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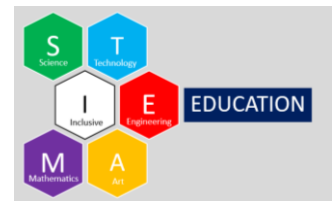
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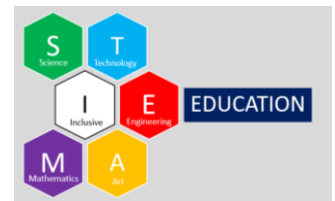
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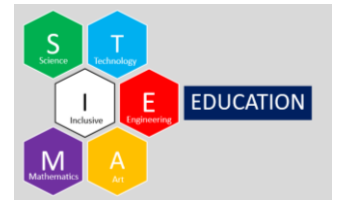
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