Developing English Learning: An Innovative Online Instructional Model with an Inquiry-Based Approach

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Abstract: This research and development (R&D) activity aims to develop a reliable, practical, and effective inquiry learning model that includes preliminary research, product design and development, and assessment. In this development process, the stages outlined by Plomp and Nieveen are adopted. Forty pharmacy students from the pharmacy study program of a state university in Malang, East Java, took part in learning during the 2021-2022 academic year. A questionnaire with Likert Scale 4 categories is a research tool. The expert validation test revealed that "Eligible" is the average result of the validator's assessment criteria. It is possible to immediately implement product results that reach 90.25% on developed media and 89.60% for digital teaching materials with interactive digital flip-book concepts. In terms of the practicality of the products developed, the average V values achieved were 0.86, 0.92, and 0.85, respectively. The results of hypothesis testing in the implementation show that Sig. value (Sig. (2-tailed)) was 0.002, which is smaller than the 0.05 significance level. Accordingly, the research findings confirm a notable improvement in students' critical thinking and problem-solving skills through the implementation of the inquiry learning model through multimedia.

INTRODUCTION

Preparing students with higher-order thinking skills and the ability to cooperate with others in developing and applying science and technology is a challenge facing the world of education, both now and in the future (Kwangmuang et al., 2021; Purwanto et al., 2023; Susilowati & Suyatno, 2021). The evidence suggests that, by and large, contemporary students tend to approach the study of science primarily through rote memorization of concepts and theories, often without effectively applying them (Fahmi et al., 2021; Khashimova et al., 2021; Rahmawati et al., 2022). Dedicated efforts are underway to enhance this situation, with a particular focus on elevating the quality of educational services offered to students (Budiharso & Tarman, 2020; du Plessis & Mestry, 2019; Sunarsi et al., 2020). Nonetheless, students may not fully grasp the significance of receiving the expected level of quality education services. Therefore, it is crucial for educators to maintain their professionalism in diverse ways to ensure that the learning process proceeds as anticipated (Dewi & Primayana, 2019; Murkatik et al., 2020; Murtiningsih et al., 2019; Rini et al., 2020).

The limitation of the "space and time" factor which has been the determining aspect of the speed and
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success of science, has shown the characteristics of the 21st century which is marked by the world of science which is increasingly interrelated in the context of the use of information and communication technology in education (Calavia et al., 2021; Erstad et al., 2021; Karatas, 2021; Xu, 2020). In accordance with the 21st-century skills map, the connection between the 21st century and skills is deeply embedded in inquiry, process knowledge, experimental design, and the habitual aspects of scientific thinking. This framework introduces a range of innovative approaches to learning, with a focus on cross-disciplinary education (Chu et al., 2017; Joynes et al., 2019; Onsee & Nuangchalerm, 2019). Based on this explanation, it is evident that educators should carefully consider the significance of imparting skills such as critical thinking and problem-solving from a young age, as these are fundamental aspects of 21st-century learning. This proactive approach is crucial for adequately preparing students for the future.

In the context of 21st-century learning and the challenges posed by technological advancements, educators are mandated to create conducive conditions and learning activities. These activities should aid students in the development of critical thinking skills and problem-solving abilities throughout their learning journey (Rahmatullah et al., 2022; Ramdani et al., 2021; Vacide Erdoğan, 2019). Problem-solving is a cognitive endeavor that utilizes knowledge and experience to discover solutions through either active engagement in activities or cognitive processes (Behnamnia et al., 2020; Md, 2019; Tang et al., 2020). The capacity to autonomously tackle problems by employing skills like analysis, interpretation, reasoning, prediction, evaluation, and reflection is vital. These 21st-century skills are acknowledged as competency standards, necessary for students to fulfill the demands of success in both their careers and future life (Fitriani et al., 2020; Kurniawan et al., 2019; Roozenbeek et al., 2022). In problem-solving, it's essential to approach challenges systematically, critically, logically, and with a resolute mindset to discover solutions.

In alignment with the framework for integrating technology in education, which is intricately linked to enhancing student learning experiences by integrating technology, pedagogy, and educational resources, the inquiry-based learning model holds promise in fostering critical and logical thinking while enhancing students' problem-solving skills (Adnan et al., 2021; Gunawan et al., 2020). Inquiry-based teaching provides students with the chance to engage actively in the learning process. This approach significantly influences students' attitudes toward learning and is associated with their ability to objectively, critically, openly, and comprehensively analyze problems. Learning through inquiry entails creating scenarios in which students can conduct their own experiments, take initiative, and draw their own conclusions (Brew & Saunders, 2020; Husni, 2020; Wale & Bishaw, 2020). Furthermore, they can establish connections between one discovery and another and make comparisons between their own findings and those of their peers.

To nurture creative thinking, learners must possess essential skills such as the ability to choose concepts, collect information, and generate ideas. Activities that stimulate creativity are incorporated into diverse learning environments, including traditional classroom instruction and online learning (Anderson et al., 2021; Jahnke & Liebscher, 2020; Shrestha et al., 2022). Incorporating investigative activities that enable students to actively seek new information during the learning process is essential. Such exercises contribute to the enhancement of students' problem-solving skills as they engage with the material presented by the teacher. These activities encompass tasks like idea
generation, connecting concepts, and formulating solutions for specific problems.

Virtual education is a significant advancement that not only impacts the educational system but also holds significance for humanity as a whole, particularly during the COVID-19 pandemic. It is imperative that every education system keeps pace with the latest developments in online education and e-learning to ensure that educational activities remain aligned with the evolving landscape, especially in this progressively digital era. In light of the current circumstances, challenges have emerged that must be addressed. Many students in the pharmacy study program at Brawijaya University in Malang encounter difficulties related to English language proficiency. This predicament has arisen due to the transition from traditional, face-to-face learning models to virtual classes, as the initial analysis indicates. Most educators primarily engage in limited discussions during virtual lectures and do not extensively utilize technology. Virtual class activities often revolve around discussions conducted through platforms like Zoom Meeting, Google Meet, or Microsoft Teams. Educational materials are typically presented in formats such as PDF files, Word documents, and PowerPoint presentations, resulting in a somewhat monotonous learning experience. Such conditions have hindered the development of critical thinking and problem-solving abilities among students.

Numerous research studies conducted by previous scholars have explored critical thinking skills and problem-solving within the framework of inquiry-based learning models. Through these models, learners can acquire the capacity to learn effectively, as well as the skills to observe, measure, gather data, and draw sound conclusions (Choowong & Worapun, 2021; Panjaitan & Siagian, 2020; Rahmi et al., 2019). The inquiry learning model, an essential element of context-based learning activities, empowers students to engage in scientific thinking and actions (Kolovou & Kim, 2020; Tari & Rosana, 2019). Many research findings have predominantly focused on students’ higher-order thinking skills, with limited discussion about efforts to enhance educators’ capabilities in planning, creating, and organizing teaching materials. This study appears to address this gap by presenting data on educators' understanding and proficiency in developing educational resources (teaching materials) for students, specifically focusing on English learning materials for pharmacy students at Brawijaya University in Malang. The study aims to assess the impact of using an inquiry-based learning approach to develop English teaching materials for these students in the context of online learning. Through the development of an online learning model utilizing the inquiry learning approach, it is anticipated that the primary educational objectives can be optimally achieved. Furthermore, this approach is expected to enhance students' critical thinking and problem-solving skills, equipping them with the necessary tools for 21st-century learning.

The educational paradigm is constructed upon a framework consisting of four essential components: a flexible environment, a conducive learning culture, deliberate content, and highly skilled professional educators (Jiang et al., 2020; Waters & Orange, 2022). In order to empower students to enhance their independent and critical thinking abilities, it is the duty of educators to steer students toward more profound learning subjects and objectives. Consequently, both educators and students must approach this undertaking with great dedication and comprehension. As a helpful tool, the software called 3D PageFlip Professional is designed for crafting digital flip-books. According to Takdir et al. (2023) and Hidayati et al. (2022), 3D PageFlip Professional is an application for creating
flash flip books, which can be utilized to transform various file types such as PDF, Word, PowerPoint, and Excel into interactive 3-dimensional flip-books, e-brochures, flip modules, and e-books with a 3D effect. Additionally, this application can be employed to produce flip modules. Previous research has indicated that incorporating multimedia in flip books can result in notable enhancements in student learning outcomes, highlighting the potential benefits of this tool (Oktarina et al., 2021; Putri & Dharma, 2023; Roemintoyo & Budiarto, 2021).

Nonetheless, there is currently a shortage of research focusing on the process of creating online learning materials using flip-books. Often, flip-books are utilized primarily as a supplementary medium rather than the central source of learning. This study aims to fill this research gap and shed light on effective approaches for developing online learning resources through the utilization of flip-books. Readers will gain valuable insights into the best practices for leveraging flip-books in the creation of online learning experiences.

Technological advancements offer a viable solution for fostering innovation in the realm of education, particularly in the creation and enhancement of learning materials. This innovation can make the learning process more engaging, ultimately increasing students' interest in learning. Achieving this objective can be facilitated through the utilization of educational media. As a result, this research has focused on the development of digital teaching materials, employing an interactive digital flip-book concept for English courses designed for pharmacy students at Brawijaya University in Malang. The media created in this research is anticipated to empower students to engage in independent learning at their convenience, harnessing the capabilities provided by the internet and technology. Furthermore, it is expected to contribute to the improvement of critical thinking and problem-solving skills among students.

**METHOD**

The purpose of this research and development (R&D) is to develop a valid, useful, and efficient Plomp-based online inquiry learning model. The stages of this development model according to Plomp & Nieveen, (2013) are the stages of preliminary research, product design and development, and assessment. The preliminary research encompassed needs and context analysis, a literature review, and the establishment of a conceptual framework for the online-based inquiry learning model. The needs and context analysis involved an examination of inquiry-based learning, an analysis of student requirements, curriculum evaluation, and a review of educational materials. The preliminary research findings led to the creation of an online-based inquiry learning model with a well-structured and valid conceptual framework for implementation. The prototype stage is where the product design for the online-based inquiry learning model is developed, comprising digital e-books or digital model books that serve as the primary developmental products.

This research was primarily focused on the product development stage. The study involved 40 students from the pharmacy study program at Brawijaya University in Malang during the 2021/2022 academic year. The research utilized a questionnaire as the primary research instrument, employing a Likert Scale with four categories (Rusimanto et al., 2021). The sampling technique employed in this study was total sampling, meaning that all available subjects were included. Data collection involved two assessments: one for validity and one for practicality. The validity assessment was categorized into five levels: invalid ($V \leq 0.00$), low validity ($0.001 \leq V \leq 0.400$), medium validity ($0.401 \leq V \leq 0.600$), high validity ($0.601 \leq V \leq 0.800$), and very high validity ($0.801 \leq V \leq 1.000$). Practicality data analysis was gathered from both lecturer and student responses to the
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learning model. This analysis encompassed indicators such as the ease of following the learning model, its utility in the learning process, the use of digital e-books as a development product, and time allocation. Practicality was assessed using a Likert scale, and the final practicality value was calculated using a specific equation.

\[
P = \frac{\text{Score obtained}}{\text{Total score}} \times 100
\]

The practicality assessment (P) is based on five categories, namely impractical \((0 \leq P \leq 20)\), less practical \((21 \leq P \leq 40)\), quite practical \((41 \leq P \leq 60)\), practical \((61 \leq P \leq 80)\), and very practical \((81 \leq P \leq 100)\).

The data analysis method employed in this study utilizes a quantitative descriptive approach. This approach involves the examination of score distributions and the percentage of rating scale categories to assess the alignment of aspects in development with the predefined criteria specified in Table 1.

<table>
<thead>
<tr>
<th>Achievement Percentage</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>76% – 100%</td>
<td>Worthy</td>
</tr>
<tr>
<td>56% – 75%</td>
<td>Decent enough</td>
</tr>
<tr>
<td>40% – 55%</td>
<td>Less worthy</td>
</tr>
<tr>
<td>0% – 39%</td>
<td>Not feasible</td>
</tr>
</tbody>
</table>

RESULT AND DISCUSSION

The following is a summary of the findings from the research and development (R&D) stage, focusing on the creation of an online learning model utilizing the inquiry learning approach to develop English teaching materials for pharmacy students at Brawijaya University in Malang. The research began with an initial phase of research and information gathering, which included a needs analysis. During this stage, it became evident that digital-based materials were of utmost importance for lecture activities for pharmacy students at Brawijaya University in Malang. Preliminary studies indicated a strong demand among lecturers for learning materials that could facilitate the enhancement of students' critical thinking and problem-solving skills in the context of online lecture activities, particularly in virtual classes. Following the needs analysis, the planning stage was initiated as part of a pilot study. The data collected during the needs analysis underscored the significance of catering to the specific requirements of pharmacy students, particularly in English courses aimed at nurturing critical thinking and problem-solving skills. This was addressed by implementing an inquiry-based learning model approach.

Product Design Stages

In the product design phase, researchers created digital teaching materials using an interactive digital flip-book concept based on the findings of the needs analysis. They then proceeded to develop online learning materials using an inquiry-based learning model approach. To facilitate the development, the researchers utilized software called 3D PageFlip Professional. Consequently, digital teaching materials with interactive digital flip-book concepts became accessible for online use. Following the creation of the flip-book, it underwent a validation process by an appointed validator. This validation process resulted in enhancements in both media content and features. The media within the flip-book was scrutinized by a media validator who assessed aspects like simplicity, integration, emphasis, balance, and color. Additionally, the content within the flip-book was reviewed and approved by a content validator in terms of content accuracy and language usage.

Product Development Stages

After the design phase of digital teaching materials with interactive digital flip-book concepts, the researchers moved forward to the implementation stage, where the design was translated into a
functional product. This product, comprising digital teaching materials with an interactive digital flip-book concept, was prepared for implementation, and its effectiveness was assessed in the subsequent phase. The product underwent rigorous testing to ensure its feasibility and suitability for its intended purpose. It began with an expert evaluation to collect feedback and recommendations for improvement. Two media experts and two material experts validated the instructional media design in the form of digital teaching materials with an interactive digital flip-book concept. Based on the findings from the media and material validation, the designed learning media was classified as "Appropriate." Subsequently, the learning media was refined based on the expert recommendations and feedback. After necessary enhancements were incorporated, all students participating in the study were given the opportunity to use the learning media during the trial. The results of the trial indicated that the learning media, in the form of digital teaching materials with interactive digital flip-book concepts, met the criteria of being "Eligible" and was ready for the implementation phase.

<table>
<thead>
<tr>
<th>Expert</th>
<th>Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Expert</td>
<td>90.25%</td>
<td>Worthy</td>
</tr>
<tr>
<td>Material Expert</td>
<td>89.60%</td>
<td>Worthy</td>
</tr>
</tbody>
</table>

The average assessment by the validators met the "Eligible" criteria. The product assessments scored 90.25% for the developed media and 89.60% for the developed materials. With these favorable results, the digital teaching materials with interactive digital flip-book concepts can be implemented as is, without the need for further revisions (Dewi et al., 2021; Setiyani et al., 2022). This is also in accordance with the results of previous research which states that the learning media developed is suitable for use in the learning process (Roemintoyo & Budiarto, 2021).

The assessment encompassed content, structure, and language validity. Product validation was conducted through written evaluations by three experts, and through discussions, a consensus was reached that the Online-Based Inquiry learning model developed was indeed valid, as indicated in Table 3.

<table>
<thead>
<tr>
<th>Product</th>
<th>Component</th>
<th>Score (V)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital flip book</td>
<td>Contents</td>
<td>0.86</td>
<td>Very high</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>0.92</td>
<td>Very high</td>
</tr>
<tr>
<td></td>
<td>Language</td>
<td>0.85</td>
<td>Very high</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>0.87</td>
<td>Very high</td>
</tr>
</tbody>
</table>

According to Plomp & Nieveen (2013), the practicality of the product developed (intervention) is seen from the ease of use. The practicality of the Online-Based Inquiry learning model is demonstrated by the consistency between the expected outcomes and the real-world assessment and implementation. This implies that the model's practicality is determined by expert evaluations, which affirm the suitability of the developed product for practical use. In this context, it is evident that the online-based inquiry learning model, as confirmed by the validators during the validation stage, can be effectively put into practice, as indicated by average V values of 0.86, 0.92, and 0.85, respectively.
The findings have yielded favorable results. The needs analysis conducted as a pilot study has furnished relevant information to inform the material developed in the ongoing study. The current research and development (R&D) endeavors have culminated in readily deployable products. Furthermore, this study has enriched the existing literature, addressing the gap concerning the demand for interactive learning materials that go beyond traditional learning resources and can be readily embraced by students. According to Plomp & Nieveen (2013), the effectiveness of the developed product (intervention) is determined by the extent to which it attains the intended objectives. This implies that the Online-Based Inquiry learning model is deemed effective if it successfully achieves its intended outcomes. Consequently, the research conducted in this study offers valuable insights for the future development of language learning materials.

The viability of the developed media is a central objective in the creation of educational tools aimed at enhancing the quality of learning and problem-solving in the classroom. This is particularly relevant for students in the pharmacy study program at Brawijaya University in Malang, with a specific focus on enhancing critical thinking and problem-solving skills in English courses. The processes and activities that aid in achieving learning objectives optimally, accurately, and efficiently, which in turn contribute to the effectiveness of learning, are crucial endeavors undertaken by educators to enhance the quality of education and attain successful learning outcomes through the use of media resources (Oktarina et al., 2021).

**Product Implementation Phase with Online Learning Model through Inquiry Learning Model Approach**

Learning systems, whether synchronous or asynchronous, incorporate the concept of inquiry-based learning (Jocius et al., 2020). The inquiry learning process and approach have been implemented in several stages, including orientation, exploration, concept formation, implementation, and closure, guided by the evaluated data. The activities for orientation, exploration, concept formation, and application at each stage of the inquiry learning model procedure have been successfully executed. To assess the effectiveness of media development in the form of digital teaching materials with interactive digital flip-book concepts when applied through online learning utilizing an inquiry learning model approach, experimental designs with single-group designs have been conducted.

Using the SPSS Statistics 26 program, data were gathered, analyzed both descriptively and inferentially, and conclusions were drawn based on the findings. Descriptive analysis involved calculating measures such as the mean, standard deviation, minimum and maximum scores, and other relevant statistics during the pre-test and post-test periods. Inferential statistical analysis was employed to interpret the results of the hypothesis testing as it was conducted. The results of the descriptive statistical analysis are presented in Table 4.

| Table 4. Descriptive Analysis of Pretest and Posttest Results. |
|-----------------|-----|-----|-------|-----|
|                 | N   | Min | Max  | Average | Std. Deviation |
| Pre-test        | 40  | 60  | 78   | 74.8    | 5.378         |
| Post-test       | 40  | 88  | 92   | 89.6    | 3.782         |
| Valid N         | 40  |     |      |         |               |

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The post-test results displayed a notable improvement compared to the pre-test, as evident in Table 4, where the mean of the pre-test was 74.8 and the mean of the post-test was 89.6. The findings indicate a statistically significant difference between the group mean before and after treatment, thanks to the inquiry learning model approach with flip-book-based digital teaching materials development media. Furthermore, the post-test had a deviation of 3.782, whereas the pre-test deviation was 5.378 (see Table 4). Given the established normal distribution of the data, as mentioned earlier, an inferential test (specifically the paired sample test) was conducted. Since there's only one group in the analysis, there was no need for a homogeneity test. The normality of the data was also verified using the Kolmogorov-Smirnov test, and the experimental results are presented in Table 5.

Table 5. Normality Test Results.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Statistic</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>1.34</td>
<td>40</td>
<td>.236</td>
</tr>
<tr>
<td>Post-test</td>
<td>1.56</td>
<td>40</td>
<td>.142</td>
</tr>
</tbody>
</table>

As indicated in Table 5, the Sig. value for the pre-test was 0.236, while the Sig. value for the post-test was 0.142, both of which are higher than the Sig. level of 0.05. A Sig. value greater than 0.05 suggests that the data follows a normal distribution, in alignment with the initial assumption. Through the paired sample testing, it can be concluded that the data from the pre-test and post-test are normally distributed and meet the criteria for hypothesis testing. Therefore, the paired sample test was employed to perform inferential analysis, as the prerequisites for hypothesis testing were satisfied. To determine whether the inquiry learning model approach through the developed media had a statistically significant impact on students' understanding in learning English, particularly in terms of critical thinking and problem-solving skills, hypothesis testing procedures were conducted. The results of these tests are presented in Table 6.

Table 6. Paired Sample Test Results.

| Mean Std. 95% Confidence Interval Sig. |
| Dev Error Lower Upper (2tailed) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|

Based on the data presented in Table 6, it can be concluded that the Sig. value (Sig. (2-tailed)) is 0.002, which is smaller than the 0.05 significance level. This indicates that the null hypothesis (Ho), which posits "There is no significant effect of the inquiry learning model approach through the developed media on students' understanding in learning English, particularly their understanding of critical thinking and problem solving," is rejected. In contrast, the alternative hypothesis (Ha) that suggests "There is a significant effect of the inquiry learning model approach through the developed media on students' understanding in learning English, especially in terms of critical thinking and problem-solving," is accepted. Additionally, the mean value is 8.912 with a standard deviation of 6.428. This finding demonstrates that the
understanding of learning English increases after the application of the inquiry learning model through the developed media. In conclusion, there is a statistically significant effect of the inquiry learning model approach through the developed media on students' understanding in learning English, particularly in the context of critical thinking and problem-solving skills.

To enhance conceptual understanding and problem-solving skills, educators should employ effective learning strategies that support comprehension and skill development. One valuable strategy for fostering conceptual understanding and problem-solving skills is the utilization of an inquiry-based learning model. Through inquiry-based learning, students are guided to enhance their conceptual understanding by engaging in activities that align with the various stages of inquiry-based learning (Sousa & Vieira, 2021). The stages of inquiry-based learning commence with the orientation to phenomena through observation, followed by problem formulation, hypothesis formulation, drawing conclusions, and generating new questions. A closer examination reveals that each stage of inquiry-based learning effectively facilitates conceptual understanding and nurtures problem-solving skills, specifically in the context of the concepts studied, such as English courses for students in the pharmacy study program at Brawijaya University in Malang.

Results are achieved upon the completion of the procedure, and conclusions are drawn in alignment with the objectives. Subsequently, students present their reports during class discussions. Throughout this process, lecturers play a pivotal role in facilitating all aspects, commencing from the application of the stages of the inquiry-based learning model to overseeing student presentations of scientific reports (Kolovou & Kim, 2020). Higuera Martínez et al. (2021) stated that many educators face challenges because they primarily pose questions related to content to gauge students' thinking capabilities. As a result, it is imperative to create questions that genuinely assess higher-order thinking skills. The assessment rubric employed in this study serves as a valuable tool for evaluating students' higher-order thinking skills, aligning with these principles.

Having established that the developed inquiry learning model approach through media significantly impacts students' understanding of critical thinking and problem-solving in the context of learning English, this research introduces pioneering strategies for leveraging flip-books to enrich the domain of online education. It presents a fresh perspective on educational progress in the digital age.

CONCLUSION

Based on the results of the research on the development of an online learning model with an inquiry learning approach through the creation of English teaching materials for pharmacy students at Brawijaya University, Malang, several key conclusions can be drawn. The average assessment by the validators yielded a "Decent" rating. The product assessment achieved values of 90.25% for the developed media and 89.60% for the developed materials. Consequently, digital teaching materials featuring interactive digital flip-books can be directly implemented. Regarding the practicality of the developed product, the online-based inquiry learning model, as evaluated by the validators during the validation stage, can be effectively implemented, as indicated by average V values of 0.86, 0.92, and 0.85, respectively. In terms of implementation, the results of hypothesis testing showed a
Sig. value (Sig. (2-tailed)) of 0.002, which is smaller than the 0.05 significance level. Hence, it can be concluded that the inquiry learning model approach through the developed media indeed has a substantial impact on students' grasp of English learning, especially in the realms of critical thinking and problem-solving.

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