

Developing an Inquiry Model for Macroeconomics Instruction to Improve Digital Skills

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Abstract. This study aims to develop an inquiry-based learning model in the subject of Macroeconomics to enhance students' digital competencies. The research method employed is research and development (R&D), conducted over the course of one year, with Accounting Education students at Universitas Negeri Medan as the research subjects. This design was chosen to produce a new product or improve an existing one, namely the inquiry learning model in Macroeconomics education. The R&D process in this study follows the ADDIE development model (Analyze, Design, Development, Implementation, Evaluation). The results show that the developed inquiry model is effective in enhancing students' active engagement, analytical thinking skills, and digital literacy in accessing, processing, and presenting economic data. These findings recommend the integration of digital-based inquiry approaches as a relevant and adaptive learning strategy to meet the demands of economics education in the digital transformation era.

Keywords: Inquiry model, macroeconomics, digital competence, active learning, model development

1 Introduction

The transformation brought about by the Fourth Industrial Revolution and the transition to the digital era has resulted in significant changes in the field of education. The integration of information and communication technology (ICT) has now become a crucial element in enhancing the effectiveness of learning processes. Several technological components that support this transformation include online learning platforms, digital collaboration tools, and technology-based educational applications, all of which facilitate the management and accessibility of learning.

In this context, learners are required to develop comprehensive digital competencies in order to adapt and make optimal use of technology. They must be able to operate various technological devices such as computers, tablets, and smartphones. This includes basic skills such as turning on devices, operating common software applications, and troubleshooting simple technical problems. Learners should also be able to access and utilize relevant digital resources to support their learning activities, such as reading and comprehending content from e-books or other digital materials, using online journals as references for assignments or research, and accessing educational videos through platforms like YouTube, Coursera, or similar services that provide high-quality video-based materials.

The ability to use digital communication tools is essential for supporting collaboration, both in small and large groups. For instance, managing communication via email to share information and engage in discussions, actively participating in online discussion groups using platforms such as WhatsApp, Telegram, or Discord, and utilizing dedicated learning platforms such as Google Classroom, Microsoft Teams, or Moodle to interact with instructors, submit assignments, and take online exams or quizzes. Through mastery of these digital competencies, learners will not only be able to leverage technology for learning but also prepare themselves to face the challenges of the digital era.

Technological advancements have thus brought significant changes in education. Educational digitalization not only transforms the way learning materials are delivered, but also how learners study, interact, and utilize technology to support the learning process. In this regard, digital competence has become a critical skill for learners to effectively employ technology in education. Such competence is not only a demand of the digital era but also serves as an essential asset to confront future challenges. With these abilities, students can become independent, creative, and adaptive learners who are capable of responding to various technological changes in both education and everyday life.

Digital-based learning has also been implemented in the Faculty of Economics, particularly within the Department of Accounting and the Accounting Education Study Program, enabling students to engage in more diverse, extensive, and enriched learning experiences.

The characteristics of the Macroeconomics course involve assessing whether an economy is developing or facing challenges. Consequently, logical, critical, and systematic thinking skills are required to comprehend the fundamental scientific concepts and innovations related to integrated and sustainable economic development. This necessitates the ability to expand networks and disseminate study findings based on the analysis of information and data.

Nevertheless, the current implementation of Macroeconomics learning appears to fall short of the expected outcomes. The applied learning methods, namely the case method and team-based project approach, are intended to improve students' critical thinking, problem-solving, and communication skills. Although instructors have adopted these methods, in practice, learners still face difficulties in processing data to connect one concept with another. Students who are not accustomed to filtering information from various digital sources are often misled by disinformation or by relying on less credible sources. Therefore, in the context of Macroeconomics learning, it is deemed necessary to develop a learning model that can enhance digital competence, thereby fostering higher-order critical thinking skills.

The Inquiry-based learning model is grounded in constructivist learning theory, which posits that knowledge is actively constructed by learners rather than passively received [1]. As an embodiment of student-centered pedagogy, this model integrates opportunities for learners to

be actively engaged in diverse classroom activities. Within this framework, inquiry learning emphasizes a structured sequence of processes, including investigation, argumentation, academic writing, and peer review. These processes are intended not only to strengthen conceptual understanding but also to cultivate scientific reasoning and higher-order thinking skills [2].

By engaging in such practices, learners are encouraged to develop autonomy, critical inquiry, and collaborative competencies, attributes that are essential in both academic and real-world contexts. Consequently, the Inquiry-based learning model provides a pedagogical framework that bridges theoretical knowledge with authentic scientific practices, thereby aligning educational objectives with the broader goals of twenty-first century learning. The research problem formulated in this study is: How can the Inquiry-based Learning Model be developed in Macroeconomics instruction to enhance students' digital competencies?

2 Method

2.1 Development Model

The research method employed in this study is Research and Development (R&D), conducted over the course of one year with undergraduate students of Accounting Education at Universitas Negeri Medan as the research subjects. This design was chosen because it aims to produce a new product or refine an existing one, namely the Inquiry-based learning model in the teaching of Macroeconomics. The R&D process in this study adopts the ADDIE model (Analyze, Design, Development, Implementation, Evaluation), as summarized in Fig. 1 [3].

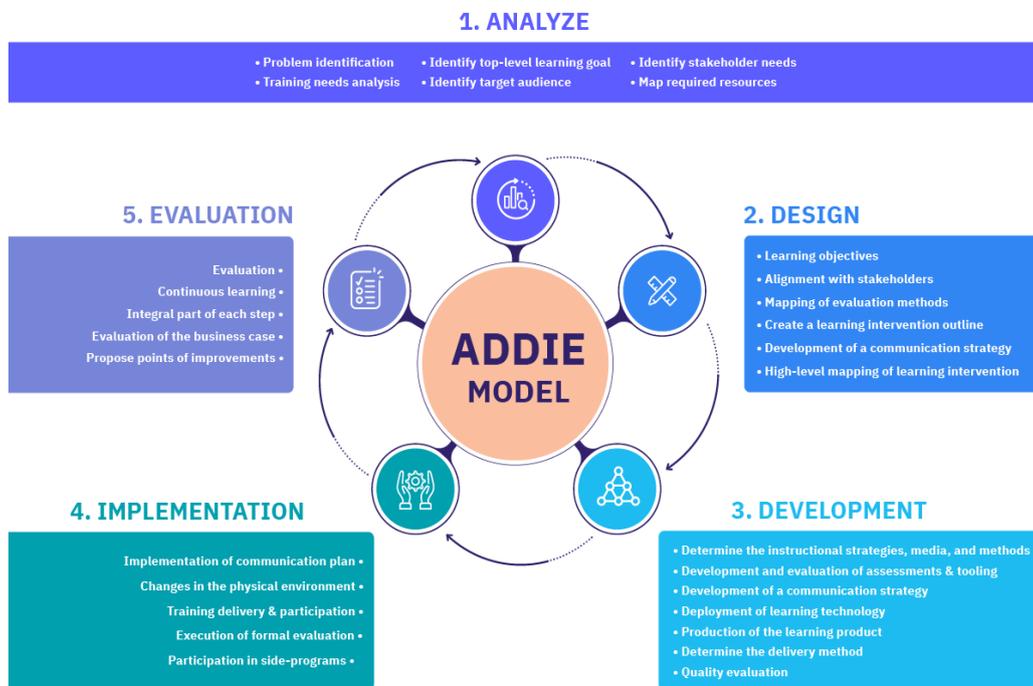


Fig. 1. ADDIE Model

2.2 Data Collection and Data Analysis Techniques

This study applied a Research and Development (R&D) approach based on established R&D procedures and was implemented using the ADDIE development model. The research was carried out over one academic year, involving undergraduate students in the Accounting Education program at Universitas Negeri Medan as the study participants [4,5].

The development procedure was carried out in several stages. The preliminary study included a literature review, a preliminary survey, and the preparation of research instruments. This stage provided the foundation for designing the initial prototype of the instructional model

The subsequent stage focused on the development of lesson plans and instructional tools, which involved the formulation of essential questions, learning concepts, content standards, lesson objectives, and estimated learning time. Within this phase, the Inquiry-based learning model was integrated into Macroeconomics instruction.

The draft learning model was then subjected to expert validation involving specialists in instructional design, subject-matter experts, and experts in learning models. Following validation, the model underwent a small-group trial, during which revisions were made based on observed weaknesses and expert feedback.

After revision, the model proceeded to a field trial to test its effectiveness in a broader learning context. This phase was followed by a final revision, producing a refined model ready for implementation.

The final product of this research is an Inquiry-based Learning Model for Macroeconomics instruction designed to enhance students' digital competencies. The research outputs include a final report, publication in an accredited national journal, presentation in an indexed international proceeding, and an intellectual property registration (HKI).

3. Results and Discussion

3.1 Analyze Stage

In the initial stage, the researcher conducted a document-based observation to identify the instructional content delivered in the second-semester Macroeconomics course. The primary sources analyzed were lesson plans, with particular attention given to the intended learning outcomes, which emphasize students' ability to address macroeconomic problems in relation to contemporary environmental conditions. This approach requires the integration of theoretical knowledge with real-world contexts, serving as both a benchmark for learning achievement and a critical component of the inquiry-based model applied in this study.

The analysis process considered two essential dimensions. First, the instructional materials embedded in the lesson plans were examined to determine the targeted learning outcomes. Second, students' understanding of the subject matter was assessed in relation to the most appropriate application of the inquiry model. To map students' prior knowledge, the researcher also reviewed supporting documents, including grades from other courses, results from mid-term examinations, and performance on various assignments. These data provided a comprehensive profile of students' initial competencies.

Findings from this analysis indicated that three clusters of topics in the Macroeconomics course posed the greatest challenges for students: economic systems, economic growth, open economy,

as well as fiscal and monetary policy. Overall, however, students demonstrated a relatively strong capacity to comprehend macroeconomic content.

3.2 Design Stage

The Inquiry-based learning model has been developed as an alternative approach to traditional instructional methods, with the aim of providing students with opportunities to actively engage in reflective scientific investigation. Through this approach, students are expected to enhance their ability to construct reasoned arguments while simultaneously developing critical thinking skills [6].

Within the Macroeconomics course which serves as a foundation for understanding the broader dynamics of economic systems the targeted competencies include: (1) the ability to analyze, discuss, and present macroeconomic issues in a critical manner; and (2) the capacity to produce scholarly work in accordance with academic conventions through the writing of structured reports. Both competencies are closely related to the strengthening of scientific argumentation, which constitutes a central goal of inquiry-based learning [7].

The initial step in designing the inquiry-based program involves the mapping of instructional content. At this stage, instructors play a pivotal role in selecting and determining the topics most suitable for inquiry activities, guided by the course syllabus (Rencana Pembelajaran Semester/RPS) for Macroeconomics. Based on this document, four major topics were identified as appropriate for independent exploration and discussion by students: economic systems, economic growth, open economy, and fiscal and monetary policy.

To ensure that the inquiry-based learning process unfolds systematically, the researcher designed an implementation strategy aligned with the syllabus and intended learning outcomes. These outcomes serve as the primary reference for the design and development of instructional materials. Specifically, the learning outcomes of the Macroeconomics course encompass: (1) the ability to apply logical, critical, and systematic reasoning in both the development and application of economic knowledge; and (2) the ability to make informed decisions in addressing economic problems by considering humanistic values, supported by accurate and relevant information and data analysis [8].

3.3 Development Stage

Macroeconomics is a fundamental course designed to equip students with a comprehensive understanding of the structure and dynamics of complex economic systems. The expected competencies of students in this course include: (1) the ability to analyze and discuss various aspects of macroeconomics and present them effectively in the form of oral presentations; and (2) the ability to produce systematic academic writing through the preparation of structured reports. Both competencies are closely related to the development of scientific argumentation skills. One pedagogical approach employed to achieve these competencies is the application of the Inquiry-based learning model, accompanied by the development of instructional materials aligned with the characteristics of this model [9].

The development stage of the Inquiry model encompasses a range of activities aimed at preparing instructional tools that support its implementation. The materials developed include: (a) an outline of learning content presented in a brief lesson plan, consisting of essential

questions, key concepts, content standards, learning objectives, and estimated time allocation; (b) the design of the Inquiry-based learning model itself; and (c) assessment instruments to measure learning outcomes.

Subsequent phases in the development process involved: (1) Expert validation of the instructional design, (2) Revisions based on expert feedback, (3) Small-scale trials, and (4) Further refinements of the model in response to trial results.

The Inquiry-based learning model that was implemented was designed with flexibility, allowing instructors to adapt its components and methods according to their pedagogical needs. Within the scope of this research, the most significant development occurred in the redesign of the Sylabuss (Rencana Pelaksanaan Pembelajaran/RPP)

This process follows the general principles of Research and Development (R&D) in education, where instructional design undergoes iterative cycles of validation, revision, and field testing before producing a final model [4]. The following section presents the results of validation conducted by experts in learning models, subject matter, instructional strategies, as well as findings from the trial implementation.

Table 1. Results of Learning Model Validation

| No | Aspect Assessed | Statement | Maximum Score | Score Obtained | Percentage (%) | Category |
|-------|--|---|---------------|----------------|----------------|-----------------|
| 1 | Alignment with Learning Objectives | The model supports the achievement of learning outcomes | 5 | 5 | 100% | Highly Feasible |
| 2 | Clarity of Syntax | Inquiry syntax is explained systematically | 5 | 4 | 80% | Feasible |
| 3 | Relevance to Macroeconomics | The model aligns with the context of macroeconomics | 5 | 5 | 100% | Highly Feasible |
| 4 | Support for Digital Skills Development | The model encourages the integration of learning technology | 5 | 4 | 80% | Feasible |
| Total | | | 20 | 18 | 90% | Highly Feasible |

Table 2. Results of Teaching Material Validation

| No | Aspect Assessed | Statement | Maximum Score | Score Obtained | Percentage (%) | Category |
|-------|--|---|---------------|----------------|----------------|-----------------|
| 1 | Alignment with Learning Outcomes (CPL) | The material is aligned with the intended learning outcomes | 5 | 5 | 100% | Highly Feasible |
| 2 | Balance of Theory and Application | The material presents both theoretical and practical applications | 5 | 4 | 80% | Feasible |
| 3 | Support for Digital Skills | The material integrates educational technology | 5 | 4 | 80% | Feasible |
| 4 | Structure and Systematics | The material is organized in a coherent and logical manner | 5 | 5 | 100% | Highly Feasible |
| Total | | | 20 | 18 | 90% | Highly Feasible |

Table 3. Results of Learning Strategy Validation

| No | Aspect Assessed | Statement | Maximum Score | Score Obtained | Percentage (%) | Category |
|-------|--|---|---------------|----------------|----------------|-----------------|
| 1 | Learning Activation | The strategy promotes active learning | 5 | 4 | 80% | Feasible |
| 2 | Collaboration and Reflection | The strategy encourages collaboration and reflection | 5 | 5 | 100% | Highly Feasible |
| 3 | Relevance to 21st-Century Learning | The strategy aligns with contemporary learning competencies | 5 | 4 | 80% | Feasible |
| 4 | Opportunities for Authentic Assessment | The strategy enables authentic assessment practices | 5 | 4 | 100% | Feasible |
| Total | | | 20 | 17 | 85% | Feasible |

Table 4. Results of Student Response Validation

| No | Aspect Assessed | Statement | Maximum Score | Score Obtained | Percentage (%) | Category |
|-------|----------------------------|---|---------------|----------------|----------------|-----------------|
| 1 | Student Engagement | I actively participated in learning activities | 5 | 4,5 | 90% | Highly Feasible |
| 2 | Ease of Use of the Model | The steps were easy to understand and follow | 5 | 4,4 | 88 % | Feasible |
| 3 | Content Relevance | The learning materials were relevant to my learning needs | 5 | 4,3 | 86% | Feasible |
| 4 | Support for Digital Skills | The learning process enhanced my digital competencies | 5 | 4,5 | 90% | Highly Feasible |
| Total | | | 20 | 17,7 | 88,5% | Feasible |

The validation results obtained from experts and students indicate that the Inquiry-based learning model developed in this study is both feasible and effective for implementation in the Macroeconomics course.

First, the validation of the learning model showed an overall feasibility score of 90% (Highly Feasible). The aspects that received the highest ratings were alignment with learning objectives and relevance to macroeconomic content, both scoring 100%. This confirms that the developed model is consistent with the expected learning outcomes and appropriately contextualized within macroeconomic subject matter. However, the aspect of clarity of syntax was rated slightly lower (80%), suggesting the need for refinement in the presentation of inquiry steps to ensure ease of implementation for instructors.

Second, the validation of the learning materials also achieved a total score of 90% (Highly Feasible). The materials were considered highly appropriate in terms of alignment with course learning outcomes (100%) and structural coherence (100%). Nevertheless, the aspects of balance between theory and application and integration of digital skills scored 80%, indicating that future improvements should emphasize the application of theoretical concepts to real-world cases while incorporating stronger digital learning components.

Third, the validation of learning strategies resulted in an overall score of 85% (Feasible). The strategy was particularly strong in fostering collaboration and reflection (100%), which are essential for inquiry-based learning. Yet, aspects such as active learning activation, 21st-century skills alignment, and authentic assessment opportunities were rated at 80%. These findings highlight the importance of reinforcing strategies that encourage student-centered activities, critical thinking, and authentic assessment practices.

Finally, the student response validation demonstrated an overall positive evaluation, with a score of 88.5% (Feasible). Students reported high engagement in the learning process (90%) and

perceived significant improvements in their digital skills (90%). The slightly lower scores on ease of use of the model (88%) and content relevance (86%) indicate that while students found the model beneficial, there remains room for enhancing clarity of implementation steps and tailoring content more closely to their specific learning needs.

Taken together, these validation results confirm that the Inquiry-based learning model is feasible, contextually relevant, and positively received by students, while also highlighting several areas for refinement. Future development should prioritize clarifying the instructional syntax, strengthening the balance between theory and practice, and expanding opportunities for digital skill development. Such improvements are expected to enhance the model's overall effectiveness in fostering critical thinking, argumentation, and scientific inquiry skills in the context of macroeconomic learning.

3.4 Implementation Stage

As an alternative to traditional pedagogical strategies, the Inquiry learning model is designed to provide opportunities for students to engage in reflective scientific inquiry. Its primary purpose is to cultivate higher-order thinking and improve students' proficiency in generating structured scientific arguments [9].

3.5 Evaluation Stage

Evaluation serves as a critical stage to assess whether the developed instructional model successfully achieves its intended goals and aligns with the initial expectations. In this study, the evaluation of the Inquiry-based learning model for Macroeconomics was carried out using the CIPP framework (Context, Input, Process, and Product), which provides a comprehensive perspective on the effectiveness and feasibility of the model.

1. Context Evaluation

The context dimension focused on the relevance of the model to the learning objectives of the Macroeconomics course. Specifically, the course is designed to foster students' ability to analyze, discuss, and present macroeconomic issues critically, while also strengthening their skills in scientific argumentation. The topics selected for evaluation—namely, the economic system, economic growth, the open economy, and fiscal and monetary policy—were identified as complex areas that students typically find challenging. Thus, the Inquiry-based approach was considered appropriate to encourage active engagement and independent exploration of these materials.

2. Input Evaluation

The input evaluation examined the resources, instructional design, and assessment instruments used in the development of the Inquiry model. The lesson plans, instructional strategies, and digital tools were assessed by experts in instructional design, content, and pedagogy. The results confirmed that the materials were aligned with the expected learning outcomes, balanced theoretical and practical aspects, and integrated technology to enhance digital literacy skills.

3. Process Evaluation

The process evaluation analyzed the actual implementation of the Inquiry-based model in classroom practice. Observations and student feedback indicated that the model fostered active participation, collaboration, and reflective thinking. Students reported that the inquiry process allowed them to better connect theoretical knowledge with real-world macroeconomic issues,

thereby deepening their understanding. Furthermore, authentic assessments embedded in the model enabled the evaluation of not only cognitive skills but also critical and digital competencies.

4. Product Evaluation

The product evaluation focused on the learning outcomes achieved through the implementation of the Inquiry model. Student performance data, including class participation, assignments, and presentations, demonstrated significant improvements in critical thinking and digital skills. Additionally, most students expressed that complex macroeconomic topics became more accessible and comprehensible when approached through structured inquiry processes.

In sum, the CIPP-based evaluation highlights that the Inquiry learning model is both feasible and effective for teaching Macroeconomics. It not only improves conceptual understanding but also strengthens essential 21st-century skills, including critical thinking, collaboration, and digital literacy.

The instruments used in this study to develop an inquiry-based learning model in Macroeconomics were first evaluated by three experts specializing in subject content, language, and instructional media. The validation process produced an average score of 0.92, which falls into the “very good” category. Furthermore, reliability testing using Cronbach’s alpha yielded a coefficient of 0.87, indicating that the instruments were both consistent and dependable for use in this research.

Learning outcomes were measured through pretest and posttest assessments as part of the evaluation procedures commonly used in Research and Development studies [4]. Before the intervention, the students’ average score in macroeconomics competency was 58.3 on a 100-point scale, and only 35% of the participants reached the minimum mastery threshold of 70. After the implementation of the inquiry-based learning model, the mean score rose to 82.6, and the proportion of students achieving mastery increased to 88%. This improvement was further supported by the calculation of the N-Gain score, which averaged 0.69 and was categorized as medium to high based on established normalized gain classification criteria [10]. These findings demonstrate that the model was effective in raising overall academic achievement.

A closer look at the specific aspects of learning provides a clearer picture of the improvement. Student engagement improved substantially, with mean scores increasing from 55.2 before the intervention to 85.4 afterward. Content relevance also showed growth, rising from 60.1 to 83.7, although this dimension registered the smallest relative improvement compared to the others. Collaboration within groups advanced from 52.8 to 80.5, while self-reflection saw the most significant increase, climbing from 50.5 to 79.9. Statistical testing confirmed that these improvements were not coincidental but highly significant ($p < 0.001$).

Observational data further reinforced these results. During classroom sessions, nearly 78% of total learning time was devoted to group discussions, indicating that students were actively engaged in collaborative inquiry. In addition, the survey of student perceptions revealed positive attitudes toward the learning model. On a five-point Likert scale, the mean scores were 4.3 for engagement, 4.1 for ease of use of materials, and 4.4 for motivation. In terms of overall satisfaction, 65% of respondents reported being “very satisfied,” 30% expressed being “satisfied,” and only 5% rated their experience as “moderately satisfied.”

The substantial improvements in student performance and perceptions highlight the strengths of the inquiry-based approach. Gains were particularly strong in collaboration and reflection, both

of which increased by more than 50%. These findings underscore the model's capacity to foster twenty-first-century skills, including teamwork and metacognitive awareness. Such results are consistent with socio-constructivist theory, which argues that learning is most effective when built through social interaction and reflective engagement [11]. Nevertheless, the dimension of content relevance, which improved by only 39%, suggests that there is still a need to strengthen the contextual connection between macroeconomic topics and students' everyday experiences or contemporary economic issues.

When compared with prior research, the findings of this study align with earlier evidence and are stronger in some dimensions. Previous work indicates that guided inquiry can produce high N-Gain outcomes in accounting education, especially for interpretation and explanation skills [12]. Inquiry-based worksheets have also been associated with mastery levels above 90% in senior high school economics [13], and inquiry-oriented interventions have been linked to increased learning interest [14]. In this study, mastery levels were comparable to those findings, with more substantial gains in collaborative and reflective skills—areas that are frequently underemphasized in conventional instruction.

From a practical perspective, these results demonstrate that integrating inquiry cycles into macroeconomics courses not only improves content mastery but also bridges the gap between theory and practice. For instructors, the model provides a structured way to promote critical thinking and digital competence. For curriculum developers, it offers evidence that inquiry-based activities should be embedded as a core part of learning design rather than as supplementary exercises.

Despite these promising results, the study is not without limitations. The sample was confined to a single program, which limits the generalizability of the findings. The posttest was conducted immediately after the intervention, leaving open the question of whether the observed gains would persist over time. Additionally, some of the instruments relied on self-reported data, which could introduce bias. Future research should therefore consider longitudinal designs to examine long-term retention, incorporate more context-specific materials such as local economic case studies to strengthen relevance, and employ learning analytics tools such as digital dashboards to monitor the inquiry process in real time [15].

Overall, the results validate the potential of inquiry-based learning as a sustainable pedagogical approach for higher education. The study reaffirms the insights of [1] and [11], who emphasized discovery and social interaction as key drivers of deeper learning. It also aligns with more recent findings [7], which highlight the capacity of inquiry-based learning to cultivate critical thinking, collaboration, and digital literacy. The positive student outcomes in this study therefore support the argument that inquiry models are highly relevant for addressing the challenges of teaching macroeconomics in the digital era.

Recent research [15], [16], [12] further supports the integration of inquiry-based methods with digital tools in higher education, while international frameworks [17], [18] confirm the relevance of such models for digital competence development.

However, the relatively lower increase in content relevance suggests that instructional materials need to be contextualized more closely with real-world economic issues [19].

4 Conclusion

The findings of this study demonstrate that the inquiry-based learning model developed for Macroeconomics is both feasible and effective in fostering meaningful learning outcomes. Expert validation confirmed that the model was strongly aligned with course objectives, relevant to macroeconomic content, and capable of supporting digital competence, with overall ratings falling into the highly feasible category. When implemented in classroom settings, the model significantly improved student achievement, as reflected in the rise of average test scores from 58.3 to 82.6 and the increase in mastery from 35 percent to 88 percent. The calculated N-Gain of 0.69 further confirmed that the intervention produced medium-to-high effectiveness.

Beyond quantitative improvements, the model also nurtured essential competencies for twenty-first-century learning. Students became more actively engaged in group inquiry, demonstrated stronger collaborative and reflective abilities, and reported higher levels of satisfaction with the learning process. These outcomes validate the inquiry approach as not merely a tool for knowledge acquisition but also as a framework for developing critical thinking, argumentation, and digital literacy. Such results echo socio-constructivist perspectives that emphasize discovery and social interaction as catalysts for deeper learning.

At the same time, the study highlights areas for refinement. While collaboration and self-reflection advanced substantially, the improvement in content relevance was more modest, suggesting the need for more contextualized materials that connect macroeconomic concepts with students' lived experiences and current socio-economic realities. Addressing this limitation, alongside clarifying the instructional syntax and expanding authentic assessment opportunities, will be crucial for strengthening the model in future applications.

Taken together, the evidence suggests that the inquiry-based model provides a promising pedagogical pathway for higher education, particularly in responding to the demands of digital transformation. By integrating inquiry cycles into economics instruction, educators can bridge the gap between theoretical knowledge and practical application, while at the same time cultivating the critical, collaborative, and digital competencies that students require to thrive in contemporary academic and professional environments.

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