



Development of POE-Based Liveworksheets E-LKPD on Inflation and Deflation to Improve Students' Critical Thinking Skills

Asimatul Konita^{1*}, Retno Mustika Dewi²

State University of Surabaya

Corresponding Author: Asimatul Konita asimatul.22093@mhs.unesa.ac.id

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ABSTRACT

The low level of critical thinking skills among students on the subject of inflation and deflation is caused by the use of monotonous printed worksheets that tend to emphasize memorization of definitions and low-level exercises (LOTs). Based on this problem, the researcher wanted to develop interactive HOTS-based E-LKPD that could help students improve their critical thinking skills. The purpose of this study was to determine the feasibility, effectiveness, and practicality of using E-LKPD. This study used the Research and Development (R&D) method and the ADDIE model with a one-group pretest-posttest trial design on 11th grade students. The results of the media expert validation of this study obtained a score of 77% (feasible), and the results of the material expert validation obtained a score of 93% (very feasible). The student response was 86% and triggered an increase in critical thinking skills with an average gain score of 0.5384 (moderate). Therefore, it can be concluded that the E-LKPD Liveworksheets based on Predict-Observe-Explain (POE) is feasible and effective in improving students' critical thinking skills

INTRODUCTION

Critical thinking skills have received increasing attention over the past decade from educators, policymakers, and business practitioners, as they are considered essential learning outcomes for both school and university students (Castaño et al., 2023). In the context of 21st-century education, students are required to possess higher-order thinking skills (HOTS), particularly critical thinking, which involves the ability to analyze, evaluate, and create solutions to complex problems (Miterianifa et al., 2021). The mastery of creative and critical thinking skills plays a crucial role in academic, professional, and personal success, as critical thinking requires in-depth information analysis, argument evaluation, and rational decision-making based on comprehensive understanding (Hakim et al., 2024).

In economic education, critical thinking skills are essential as students are expected to analyze data, interpret graphs, and evaluate real-world economic phenomena (Joseph, 2023). However, topics such as inflation and deflation are often perceived as abstract, requiring students to connect theoretical concepts with real-life situations. Previous studies indicate that students frequently face difficulties in applying economic concepts to real-world contexts due to the abstract nature of learning and the lack of contextual teaching approaches (Tang, 2019) (Pühringer & Bäuerle, 2019). Additionally, students often struggle with graph literacy, such as interpreting trends, slopes, and curve shifts, which are fundamental skills in understanding inflation and deflation (Brückner et al., 2020) (Ring & Oberrauch, 2024).

This issue is further supported by international assessment data. The Programme for International Student Assessment (PISA) 2022 reported that Indonesia achieved an average score of 369, significantly below the OECD average (470–485), ranking 69th out of 81 countries. This result reflects low levels of literacy, numeracy, and scientific reasoning, which are foundational to economic understanding. Although PISA does not directly assess economics, these competencies are closely related to students' ability to think critically and understand economic concepts in real-life contexts.

Based on preliminary observations conducted at SMA Negeri 4 Sidoarjo, learning activities still rely heavily on printed worksheets (LKPD) as the primary instructional media. While LKPD serves as a structured learning guide, its printed format lacks interactivity, as it mainly presents text and questions without multimedia support such as videos, dynamic graphs, or simulations. Consequently, it does not effectively facilitate students' engagement or support the development of critical thinking skills. Furthermore, the LKPD used tends to be generic, less contextual, and focused on lower-order thinking skills, such as memorization, rather than analytical and evaluative processes.

In classroom practice, students tend to complete tasks mechanically without engaging in deeper analysis or reflection. Learning activities are often dominated by teacher instructions, with limited opportunities for students to explore ideas, interpret data, or solve contextual problems independently. As a result, students' participation remains low, and their ability to connect economic concepts with real-life situations is not optimally developed.

In addition, the implementation of cooperative learning models, such as Numbered Heads Together (NHT), has not been fully effective in promoting deep understanding. In practice, learning activities often become procedural and mechanical, with students passively following steps rather than actively constructing knowledge. As a result, classroom discussions tend to be superficial, and students remain passive recipients of information, which limits their ability to develop critical thinking skills. Moreover, students often rely on more dominant group members during discussions, which reduces individual accountability and limits the development of independent thinking skills. This situation indicates that the learning process has not yet fully supported the development of higher-order thinking skills, particularly critical thinking (Khairunnisa Dwinalida & sholeh setiaji, 2025).

To address these issues, innovative and interactive learning media are needed to support student-centered learning. One potential solution is the development of electronic student worksheets (E-LKPD) integrated with digital platforms such as Liveworksheets. This platform enables the use of multimedia elements and interactive features, including drag-and-drop activities and instant feedback, which can improve student engagement and understanding (Ansoriyah & Supardi, 2025) (Retsi et al., 2025). In addition, technology integration contributes to the development of students' critical thinking, creativity, and collaboration skills while providing more flexible and innovative learning experiences (S.M. Yusuf & Syarifah Kamariah, 2025) (Siringoringo, 2024). Furthermore, the integration of the Predict-Observe-Explain (POE) model encourages students to actively construct knowledge through prediction, observation, and explanation activities, which have been proven effective in improving critical thinking skills (Amirullah et al., 2019).

Previous studies have demonstrated that the use of Liveworksheets-based E-LKPD can improve students' learning outcomes and motivation (Tika Fahmi Afifah & Junaedi, 2024), while the integration of the Predict-Observe-Explain (POE) model has proven effective in developing higher-order thinking skills (Putria, 2024) (Febryanti & Rusmini, 2022). In addition, the implementation of the POE model in science learning has been shown to enhance students' critical thinking skills at a high category level (Permatasari et al., 2023), strengthen conceptual understanding (Furqani et al., 2018), and foster students' critical attitudes and self-confidence in online learning environments (Hong et al., 2021).

In addition, previous studies highlight that digital learning media can create more engaging and student-centered learning environments, while inquiry-based models such as POE are effective in stimulating students' curiosity, reasoning, and critical thinking processes. These findings suggest that both technological integration and appropriate learning models play a crucial role in improving learning quality. However, most existing studies focus on science subjects, such as physics and natural sciences, while research on the integration of POE-based E-LKPD using Liveworksheets in economic learning, particularly on inflation and deflation topics, remains limited.

Furthermore, prior studies tend to examine the use of digital worksheets and learning models separately, without integrating both into a comprehensive

instructional design. In the context of economics education, especially on abstract topics such as inflation and deflation, there is still limited research that combines interactive digital media with structured learning models to support students' analytical and critical thinking skills.

This gap highlights the need for innovative instructional media that not only present economic concepts contextually but also promote students' critical thinking skills. Therefore, this study offers a novel contribution by integrating Liveworksheets-based E-LKPD with the Predict-Observe-Explain (POE) model in economic learning. This integration is expected to provide a more interactive, contextual, and student-centered learning experience, particularly in helping students analyze economic data, interpret graphs, and relate concepts to real-life phenomena. Therefore, this study aims to develop and evaluate a Liveworksheets-based E-LKPD integrated with the Predict-Observe-Explain (POE) model to improve students' critical thinking skills on inflation and deflation material.

LITERATURE REVIEW

Constructivism Theory

Constructivism posits that knowledge is actively constructed through learners' experiences and interactions, while teachers act as facilitators (Julia et al., 2024) (Suryana et al., 2022). Learning is an active and continuous process emphasizing critical thinking, motivation, and self-regulation (Do et al., 2023), which can be supported by strategies such as Predict-Observe-Explain (POE) (Taber, 2024). This approach promotes contextual and problem-based learning, although it may involve challenges in implementation and assessment (Suparlan, 2019).

Cognitive Theory of Multimedia Learning (CTML)

The Cognitive Theory of Multimedia Learning (Mayer) explains that learning is enhanced when verbal and visual materials are integrated in accordance with human cognitive architecture and limited working memory capacity (Sorden, 2020). Well-designed multimedia instruction improves conceptual understanding, retention, and critical thinking skills (Candido & Cattaneo, 2025). Core principles such as coherence, segmentation, and modality provide essential guidelines for the design of digital learning media.

Learning Media

Learning media enhance instructional effectiveness, motivation, and student engagement (Saddam Husein, 2018) (Pagarra H & Syawaludin, 2022). They improve learning outcomes by facilitating understanding and retention (Sapriyah, 2019) (Ani Daniyati et al., 2023) (Angely Noviana Ramadani, Kartika Chandra Kirana, Umi Astuti, 2023). Media include visual, audiovisual, multimedia, and real objects, serving cognitive, affective, and attentional functions in learning (Syarifuddin & Utari, 2022).

Electronic Student Worksheets (E-LKPD)

E-LKPD are digital worksheets designed to improve flexibility, interactivity, and learning effectiveness (Shalahuddin & Hayuhantika, 2022). They enhance student participation and critical thinking skills (Syafitri & Tressyalina, 2020) (Ardiansah & Zulfiani, 2023) although their implementation

depends on teacher competence and technological support (Hamidah & Mastoah, 2025).

Liveworksheets Platform

Liveworksheets is a web-based platform that converts worksheets into interactive digital formats (Hendriani et al., 2022) (FARIDI, 2023). It integrates multimedia and interactive features such as drag-and-drop and matching tasks to enhance (Heny Nirmayani, 2022) (Dara Julita, 2025) (Putri & Erita, 2025). However, effective use requires teacher training and appropriate instructional design (Firtsanianta & Khofifah, 2022).

Predict-Observe-Explain (POE) Model

POE is a constructivist learning model consisting of prediction, observation, and explanation phases White & Gunstone, 1992 (Nugraha et al., 2019). It enhances conceptual understanding, critical thinking, and learning outcomes through active knowledge construction (Murtihapsari et al., 2022) (Rima Rikmasari et al., 2022). Its implementation requires structured planning and adequate learning resources (Muna, 2017) (Rosidah et al., 2021) (Fadly, 2022).

Students' Critical Thinking Skills

Critical is a key 21st-century skill involving analysis, evaluation, inference, and decision-making (Facione, 2015). It supports students in solving complex problems and connecting theory with real-world contexts (Mulyani, 2022) (Rahardhian, 2022) (Febrianti et al., 2021). In economics education, critical thinking is essential for understanding economic phenomena, and its development can be enhanced through active learning strategies such as POE ((Thi Phuong Thao, 2023) (Siegfried & Colander, 2022) (Taar & Palojoki, 2022).

METHODS

This study employed a Research and Development (R&D) approach, which is a systematic process used to develop and evaluate the feasibility of educational products (Umar et al., 2023). The product developed in this study was an electronic student worksheet (E-LKPD) based on the Liveworksheets platform for inflation and deflation material. The product was tested for its feasibility and effectiveness through expert validation before being implemented in the learning process.

The development model used in this study was ADDIE, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). This model was selected because it is systematic and capable of producing structured and effective learning products (Zamsiswaya, Syawaluddin, 2024), as well as creating meaningful learning experiences (Adeoye et al., 2024).

The research procedure followed the ADDIE stages. (1) In the **analysis stage**, performance analysis was conducted through observations and interviews at SMA Negeri 4 Sidoarjo, along with a needs analysis to identify students' requirements for interactive learning media that can improve critical thinking skills. (2) In the **design stage**, the E-LKPD was designed using the Predict-Observe-Explain (POE) model, including the preparation of learning materials, format, and assessment instruments. (3) In the **development stage**, the product

was developed, item analysis was conducted, expert reviews were carried out, followed by revisions and validation by material and media experts. (4) In the **implementation stage**, a limited trial was conducted involving 36 students of class XI-L at SMA Negeri 4 Sidoarjo, and student responses were collected through questionnaires. (5) In the **evaluation stage**, formative evaluation was conducted to improve the product based on expert feedback and trial results.

The study employed a one-group pretest-posttest design (Sugiyono, 2020) to measure the effectiveness of the E-LKPD.

Tabel 1. Research Design: One-Group Pretest-Posttest Design

<i>Pretest</i>	<i>Treatment</i>	<i>Posttest</i>
01	X	O2

The research subjects consisted of two material experts (an economics teacher and a lecturer), one media expert, and 36 students of class XI-L at SMA Negeri 4 Sidoarjo. The data used in this study included qualitative and quantitative data. Qualitative data were obtained from interviews, observations, and expert suggestions to determine the practicality and quality of the product (Hengki Yulhafiz Elva, 2025). Meanwhile, quantitative data included expert validation results, student response questionnaire scores, and pretest and posttest scores to measure learning effectiveness (Waruwu et al., 2025).

The data collection instruments included interviews, tests, and questionnaires. Interviews were used to obtain preliminary information regarding learning needs. The tests consisted of pretest and posttest items developed based on critical thinking indicators proposed by (Facione, 2015), covering cognitive levels C2-C6. Questionnaires were used to collect validation data from experts and student responses, using a Likert scale.

Tabel 2. A Likert scale was used in the validation sheets for content experts, media experts, and student response questionnaires.

Criteria	Score
Very Good	5
Good	4
Fair	3
Poor	2
Very Poor	1

Data analysis was conducted using both qualitative descriptive and quantitative techniques. Validation and questionnaire data were analyzed using percentage calculations with the following formula:

$$\text{Presentase (\%)} = \frac{\text{Jumlah Skor Total (X)}}{\text{Skor Maksimal (xi)}} \times 100$$

Where :

X = total score obtained

Xi = maximum possible score

The results were then interpreted using the following feasibility criteria:

Tabel 3. Likert Scale and Its Criteria

Score Range	Interpretation
81% - 100%	Very Feasible
61% - 80%	Feasible
41% - 60%	Fairly Feasible
21% - 40%	Less Feasible
0% - 20%	Not Feasible

Instrument testing included validity and reliability tests. Validity was tested using Pearson correlation with a significance level of Sig. < 0.05 indicating valid items. Reliability was tested using Cronbach's Alpha, with a range of 0.70–0.95 indicating that the instrument is reliable (Tavakol & Dennick, 2011).

To measure the effectiveness of the E-LKPD in improving students' critical thinking skills, the N-gain score proposed by Hake (1998) was used. The N-gain calculation aims to determine the level of improvement between pretest and posttest scores, using the following formula (Sukarelawan et al., 2024) :

$$N\text{-Gain} = \frac{\text{skor posttest} - \text{skor pretest}}{\text{skor maksimal} - \text{skor pretest}}$$

The N-gain results were interpreted using the following criteria (Hardiyantari, 2017) :

Tabel 4. kriteria interpretasi nilai N-Gain Score

Core Range	Category
$(N\text{-gain}) \geq 0,7$	High
$0,7 < (N\text{-gain}) \geq 0,3$	Medium
$(N\text{-gain}) < 0,3$	Low

Thought these analytical procedures, this study is expected to provide a comprehensive description of the development process, feasibility, practicality, and effectiveness of the POE-based E-LKPD in improving students' critical thinking skills.

RESULTS

This study is a Research and Development (R&D) study aimed at producing an E-LKPD based on Liveworksheets using the Predict–Observe–Explain (POE) model. The development process employed the ADDIE model, consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). Each stage was systematically conducted to ensure that the product met instructional needs and effectively improved students' critical thinking skills. Effectiveness was measured using pretest and posttest scores analyzed through N-Gain analysis.

Analysis

The analysis stage was conducted through observation and interviews at SMA Negeri 4 Sidoarjo to identify learning needs. The analysis included performance, needs, and learning objectives.

First, the performance analysis showed that economics learning had implemented the Merdeka Curriculum. Teachers had attempted to use cooperative learning models such as Numbered Head Together (NHT); however, student engagement and conceptual understanding remained suboptimal. Existing worksheets were still conventional and print-based, dominated by summaries and LOTS-level questions, with limited use of data, graphs, and contextual problems. Consequently, students' critical thinking skills had not developed optimally.

Second, the needs analysis indicated that teachers required interactive learning media capable of promoting HOTS, while students needed flexible and engaging learning resources. Therefore, an E-LKPD based on the Predict–Observe–Explain (POE) model integrated with Liveworksheets was developed to facilitate multimedia integration and contextual data analysis. This aligns with 21st-century skills demands and technology-enhanced critical thinking development (Shahab & Barak, 2025).

Third, learning objectives were formulated to cover cognitive, psychomotor, and affective domains in accordance with the Merdeka Curriculum, integrating learning outcomes (CP), learning objectives (TP), and learning flow (ATP) to support contextual learning and critical thinking development (Bait et al., 2025) (Mahardika et al., 2024).

Tabel 5. Learning Outcomes for Economics in Phase F of the Merdeka Curriculum

Conceptual Understanding		Process Skills	
Covers fundamental economic concepts, national income, unemployment, inflation, fiscal and monetary policy, international economics, and accounting basics, as well as analysis of economic issues in daily life.	Observing, analyzing, validating conclusions, results, and collaborative problem-solving.	questioning, collecting data, drawing information, communicating, and	

Learning outcomes were then translated into specific learning objectives for inflation and deflation topics as follows:

Tabel 6. Learning Objectives for Inflation and Deflation Topics

No.	Materi	Aspect	Indikator
1.	Inflasi & Deflasi	Cognitive	Students are able to predict the impact of food price increases on the economic and social conditions of society.
2.			Students are able to identify the factors causing inflation and deflation based

No.	Materi	Aspect	Indikators
			on observed economic data and phenomena.
3.			Students are able to understand the cause-and-effect relationship between changes in supply, prices, and societal welfare.
4.		Psycomotor	Students are able to present an evaluation of government policies in controlling inflation and maintaining price stability in the form of presentations.
5.			Students are able to visualize the process of inflation and deflation using images, diagrams, or graphs.
6.		Affective	Students are able to demonstrate critical and responsible consumer behavior in responding to price increases.

Design

Based on the needs analysis, the main problem identified was low critical thinking skills in inflation and deflation topics, requiring the development of interactive E-LKPD.

The design stage involved preparing instructional content, interactive features, and learning activities. An introductory video was created using CapCut, containing concepts, data, graphs, and contextual case studies. The video was uploaded to YouTube and integrated into Liveworksheets.

The E-LKPD interface was designed using Canva with a structured layout, blue-yellow color scheme, and components such as learning outcomes, instructions, and learning activities. A total of 25 interactive items were developed, including checklists, drag-and-drop, matching, and essay questions.

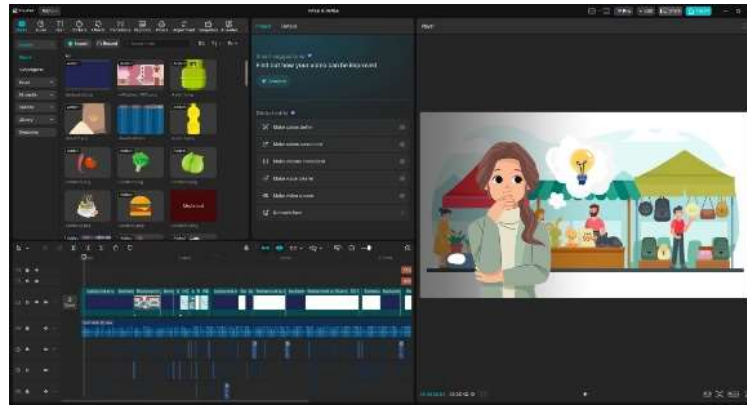
The learning activities were structured based on the POE model; predict, students formulate initial predictions; observe, students analyze BPS data, graphs, and economic cases; explain, students justify and present their conclusions.

Development

This stage involved transforming the design into a complete E-LKPD product and conducting expert validation.

1) Video Development

The instructional video was developed through scripting, storyboarding, and visual preparation, then edited using CapCut and uploaded to YouTube as a learning resource.



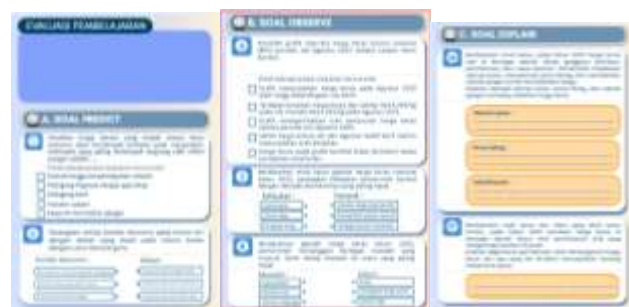
Figur 1. Video Editing Process Using CapCut

2) E-LKPD Design Development

The E-LKPD was designed using Canva with a structured layout, a blue-white dominant color scheme, and integrated components such as cover page, introduction, learning outcomes (CP), learning objectives (TP), user instructions, and POE-based learning activities. The tasks were developed in interactive formats, including checklists, drag-and-drop, matching, short-answer, and essay questions, with a box-based design to ensure neatness and readability.



Figur 2. Design Process of E-LKPD (Cover, Preface, and Competency Sections) Using Canva





Figur 3. E-LKPD Design Stage: Aligning Questions with the POE Model Using Canva

On the worksheet pages, the E-LKPD was designed using frames (boxes) as containers for each item as well as answer spaces to maintain organization and facilitate students' understanding of each task. The use of boxes helps visually distinguish each question and allows students to focus on one activity at a time. Each box was proportionally arranged with sufficient spacing to avoid a crowded appearance and to ensure readability.

The question layout was adapted to various item types, such as checklists, drag-and-drop, matching, structured short answers, and essays. For analytical and essay questions, larger response spaces were provided to allow students to present systematic and well-organized answers. In addition, question numbering and separator lines were consistently arranged to clarify the learning structure.

The tasks were organized according to the Predict–Observe–Explain (POE) stages, with clear labels for each phase to ensure a systematic learning flow. Background colors and border designs were aligned with the main E-LKPD theme to maintain visual harmony and readability. After completion, the E-LKPD design was reviewed and refined before being uploaded to Liveworksheets to support interactive and structured learning.

3) Integration Into Liveworksheets

The integration process of the E-LKPD into the Liveworksheets platform began with creating a teacher account as the manager of the digital worksheet. Subsequently, the E-LKPD file designed using Canva was uploaded and adjusted to ensure proper display on each page.

The next step involved embedding the instructional video created using CapCut and uploaded to YouTube, which was integrated into the E-LKPD as the main learning resource for the observe stage. In addition, the researcher configured interactive areas for each question according to its type, such as checklists, drag-and-drop, matching, short-answer, and essay formats, enabling students to complete the tasks directly and interactively.

Finally, a functionality and display test was conducted to ensure that all elements worked properly. Thus, the E-LKPD was ready to be implemented in economics learning on inflation and deflation topics.



4) Expert Validation Analysis

The product validation analysis was conducted based on questionnaires completed by expert validators, consisting of media experts and content experts. The collected data included quantitative scores and qualitative feedback in the form of suggestions and comments from each validator. This validation process aimed to assess the feasibility and validity of the developed learning media. The E-LKPD was evaluated by experts to ensure its suitability in terms of design, content, and instructional aspects. The validation results were then used as the basis for revising and refining the product prior to implementation.

Tabel 7. Results of Media Expert Validation Analysis

Aspect	Score	Category
Visual Attractiveness	73%	Feasible
Display Design	78%	Feasible
Instructional Aspect	80%	Feasible
Overall Average	77%	Feasible

Based on these results, the average scores for visual attractiveness, display design, and instructional aspects were 73%, 78%, and 80%, respectively, with an overall average of 77%, categorized as feasible. This indicates that the developed E-LKPD meets the required criteria for instructional use.

Tabel 8. Results of Content Expert Validation Analysis

Aspect	Score	Category
Core Competency Component	95%	Highly Feasible
Language Component	98%	Highly Feasible
Presentation Component	98%	Highly Feasible
Graphic Component	80%	Feasible
Overall Average	93%	Highly Feasible

The results show that the average scores for core competency, language, presentation, and graphic components were 95%, 98%, 98%, and 80%, respectively, with an overall average of 93%, categorized as highly feasible. This validation was conducted by two experts, namely a lecturer from the Economics Education Department of Universitas Negeri Surabaya

and an economics teacher at SMA Negeri 4 Sidoarjo. The results indicate that the content of the E-LKPD is appropriate and suitable for use in learning activities.

Suggestion from the validators were used for revision, including improving hyperlink accessibility to ensure direct access and refining the wording of questions to make them clearer and less ambiguous.

5) Implementation

In the implementation stage, the E-LKPD was tested on 36 students of class XI-L at SMA Negeri 4 Sidoarjo. Before the learning process, a pretest was conducted to measure students' initial critical thinking skills. The results showed that only three students achieved the minimum mastery criteria, while the remaining 33 students were below the passing standard (KKM). This condition was influenced by the use of conventional learning media in the inflation and deflation topic.

After identifying students' initial abilities, the learning process was designed using the POE model integrated into the Liveworksheets-based E-LKPD. In the predict stage, the teacher presented a real-world phenomenon in the form of rising rice price trends in 2025 through videos and interactive graphs within the E-LKPD. Students were asked to provide initial predictions regarding the causes and impacts of the phenomenon based on their prior knowledge. This activity was conducted individually using students' smartphones by completing interactive tasks such as multiple-choice questions, matching, and drag-and-drop activities. This stage aimed not only to activate prior knowledge but also to train students' ability to formulate logical, systematic, and evidence-based hypotheses.

In the observe stage, students were guided to conduct a more in-depth analysis of the provided data and information. The data were sourced from the Central Bureau of Statistics (BPS) and presented in the form of graphs, tables, and relevant economic news related to inflation and deflation. Through the Liveworksheets-based E-LKPD, students analyzed case studies by identifying cause-and-effect relationships, comparing economic conditions, and examining the consistency between their initial predictions and the actual findings. This activity was designed to develop students' analytical and interpretative skills as well as their ability to connect theoretical concepts with real-life economic phenomena.

In the explain stage, students presented their observations and analysis either in written form through the E-LKPD or orally during class discussions. They were required to provide logical and scientific reasoning regarding the alignment or misalignment between their initial predictions and observational results. The teacher then played a role in strengthening concepts, correcting misconceptions, and connecting the discussion outcomes with the theory of inflation and deflation in a more comprehensive way through explanation and presentation media. This stage is crucial in developing students' ability to construct arguments, draw conclusions, and communicate ideas in a structured and systematic manner.

After the treatment was implemented, the posttest results showed a significant improvement. A total of 31 students achieved the minimum mastery criteria, while 5 students had not yet reached it, although their scores also improved. This improvement indicates that the use of Liveworksheets-based E-LKPD with the POE model was able to create a more interactive, engaging, and meaningful learning environment. In addition, supporting media such as contextual data visualization videos also contributed to increasing students' learning motivation and critical thinking skills in understanding economic concepts.

6) Evaluation

This study was limited to a small-scale trial involving 36 Grade XI students at SMA Negeri 4 Sidoarjo. The evaluation was conducted based on feedback and suggestions from experts and the results of the trial to further refine the POE-based Liveworksheets E-LKPD for broader implementation.

Revision were made to both content and media aspects in accordance with expert recommendations before the product was implemented in classroom learning. The results indicated that the E-LKPD was generally effective; however, there were still challenges related to ease of use, particularly in understanding the types of questions provided.

Therefore, clearer and more detailed usage instructions are needed to support students' independent learning and to optimize the effectiveness of the E-LKPD in future applications.

7) Research Results

a. Item Validity Test Results

The item validity test was conducted prior to the implementation of the pretest and posttest on 25 test items outside the research sample using SPSS software. Based on the analysis results, 20 items were declared valid because they had a significance value (Sig.) < 0.05 , while 5 items were declared invalid because they had a Sig. value ≥ 0.05 .

The invalid items need to be revised or removed before use. Overall, the developed instrument has good validity and is suitable for use as a measurement tool in the pretest and posttest.

b. Reliability Test Results

The reliability test was conducted after identifying valid items to determine the instrument reliability using Cronbach's Alpha analysis. A higher Cronbach's Alpha value indicates stronger internal consistency of the instrument.

Based on the results, the Cronbach's Alpha value was 0.708 with 25 items, indicating that the instrument has good reliability. This means the instrument is consistent and reliable for measuring students' learning outcomes.

c. Normality Test Results

The normality test was conducted using SPSS on pretest and posttest data from 36 students using the Shapiro-Wilk method. The results are presented in the table below:

Tabel 9. Normality Test Using the Shapiro–Wilk Method

	Kolmogorov-Smirnov			Shapiro Wilk		
	statistic	df	Sig.	statistic	df	Sig.
Pretest	.148	36	.044	.924	36	.016
Posttest	.234	36	.000	.699	36	.000

The results show that the significance values of the pretest (0.016) and posttest (0.000) were less than 0.05, indicating that the data were not normally distributed. Therefore, further analysis was conducted using the non-parametric Wilcoxon test.

d. Wilcoxon test Results

Tabel 10. Non-Parametric Wilcoxon Signed-Rank Test

	N	Mean Rank	Sum of Ranks
Posttest - Pretest			
Negative Ranks	1	4.50	4.50
Positive Ranks	34	18.40	625.50
Ties	1		
Total	36		

The Wilcoxon test results show that 34 students experienced improvement (positive ranks), 1 student decreased (negative ranks), and 1 student remained unchanged (ties). The significance value of 0.000 (< 0.05) indicates a significant difference between pretest and posttest results. Thus, the treatment significantly improved students' critical thinking skills.

e. N-Gain Score results

Tabel 11. Results of N-Gain Score Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
NGain_Score	36	-.13	.94	.5384	.23076
NGain_Persen	36	-13.24	93.85	53.8358	23.07604
Valid N (listwise)	36				

The results show an average N-Gain score of 0.5384, categorized as medium, indicating a moderate improvement in students' critical thinking skills. The minimum value (-0.13) shows a slight decrease in some students, while the maximum value (0.94) indicates a high improvement. Overall, the intervention was moderately effective.

f. Student Response Questionnaire Results

Tabel 12. Student Response Analysis Results

Aspect	Score	Category
Learning Aspect Average	87%	Very Feasible
Quality Aspect Average	87%	Very Feasible
Function Aspect Average	84%	Very Feasible

Aspect	Score	Category
Appearance Aspect Average	86%	Very Feasible
Overall Average	86%	Very Feasible

The results show that the learning aspect scored 87%, quality 87%, function 84%, and appearance 86%, with an overall average of 86%, categorized as "very feasible." This indicates that the developed E-LKPD is highly feasible and effective for use in learning activities.

DISCUSSION

Feasibility of the POE-Based Liveworksheets E-LKPD

The development of a Liveworksheets-based E-LKPD integrated with the Predict-Observe-Explain (POE) model on inflation and deflation material was conducted to examine its feasibility in improving students' critical thinking skills. The development process followed the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. During the analysis stage, the findings revealed the need for interactive and contextual learning media capable of engaging students actively in the learning process. In the design stage, the E-LKPD was developed based on the Cognitive Theory of Multimedia Learning (CTML), emphasizing the integration of text, images, and videos to optimize cognitive processing and reduce cognitive overload (Sorden, 2020) (Candido & Cattaneo, 2025).

The development stage was conducted systematically following the principles proposed by Prastowo (2014) in (Muhammad Danial, 2020), including expert review and validation processes. The implementation stage involved classroom learning activities using the POE approach, which encouraged students to construct knowledge actively through prediction, observation, and explanation activities. The evaluation stage ensured that the developed product met the expected learning objectives. The results of expert validation indicated that the E-LKPD fulfilled the feasibility criteria and was considered appropriate for implementation in learning activities (Sugiyono, 2020). These findings are supported by previous studies stating that digital E-LKPD integrated with the POE model can improve learning outcomes and foster students' critical thinking skills (Wulandari & Nofina, 2022) (Putria, 2024) (Arthamena et al., 2023) (Ulyatin et al., 2023).

Effectiveness of the POE-Based Liveworksheets E-LKPD

The effectiveness of the E-LKPD was reflected in the improvement of students' learning outcomes after implementation. Students demonstrated better performance in understanding economic concepts, particularly in analyzing, evaluating, and drawing conclusions related to inflation and deflation. The observed improvement indicates that the POE-based learning process facilitates active knowledge construction through prediction, observation, and explanation activities. This finding is aligned with the theory of critical thinking proposed by (Facione, 2015), which emphasizes analytical, evaluative, and inferential skills in learning.

In addition, the statistical testing confirmed that the implementation of the E-LKPD contributed significantly to the improvement of students' critical thinking skills. The obtained N-Gain score was categorized as moderate, indicating that the developed learning media was effective in enhancing higher-order thinking skills. These findings are supported by previous studies showing that POE-based E-LKPD can improve students' critical thinking abilities and provide meaningful learning experiences (Dewi et al., 2018) (Ulyatin et al., 2023) (Alfiyanti et al., 2020) (Choiroh et al., 2022) (Furqani et al., 2018).

Practicality of the POE Based Liveworksheets E-LKPD

The practicality of the E-LKPD was evaluated based on students' responses after participating in the learning process. The results indicated that students had very positive perceptions regarding the use of the E-LKPD in classroom activities. Students reported that the E-LKPD helped them better understand the material, increased their engagement through structured POE activities, and supported independent learning.

The interactive features, such as drag-and-drop activities, matching tasks, essay questions, and guided short-answer exercises, along with clear instructions and attractive visual design, contributed to increased motivation and participation during learning. Students also perceived the E-LKPD as easy to use and beneficial in connecting economic concepts with real-life phenomena related to inflation and deflation. These findings are in line with (Lin & Yu, 2023), who state that learning media can be considered practical when they are easy to use and effectively support learning activities. Overall, the integration of Liveworksheets with the POE model provides a meaningful and interactive learning environment that supports the development of students' critical thinking skills and can be effectively implemented in economics learning.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The POE-based E-LKPD developed using Liveworksheets was declared feasible for use based on expert validation results, which indicated its alignment with content standards, assessment criteria, and required student competencies. The feasibility, effectiveness, and practicality tests further confirmed that the media is appropriate for use in learning economics topics, particularly inflation and deflation. Based on the research analysis, the following conclusions were obtained:

1. **Validity of the E-LKPD** : The E-LKPD achieved a validity score of 93% for the material aspect and 77% for the media aspect. These results indicate that the developed product meets the required standards of content, instructional design, and student competency alignment, and is categorized as valid and feasible for classroom use.
2. **Effectiveness of the E-LKPD** : The effectiveness of the E-LKPD is demonstrated by an N-Gain score of 0.5384, which falls into the moderate category. This indicates that the use of POE-based Liveworksheets contributes to improving students' critical thinking skills in economics learning, particularly on inflation and deflation topics.

3. **Practicality of the E-LKPD** : Based on student responses, the practicality level reached 86%, categorized as highly feasible. This shows that students found the E-LKPD easy to use, engaging, and helpful in supporting the learning process.

The POE-based E-LKPD developed using Liveworksheets is considered valid, effective, and practical as a learning medium for supporting interactive and student-centered economics learning.

Recommendation

1. Teacher are recommended to integrate POE-based E-LKPD into economics learning to create more interactive and student-centered learning environments.
2. Schools should provide adequate technological infrastructure to support the implementation of digital learning media.
3. Future researchers are encouraged to expand the study to larger samples and different learning materials to improve generalizability.
4. Further development is suggested to enhance interactivity features and improve accessibility for broader educational use

FURTHER STUDY

This section briefly presents the limitations of the study and suggestions for future research.

1. This study focused on developing a Liveworksheets-based E-LKPD using the POE (Predict–Observe–Explain) model in economics learning.
2. The material was limited to inflation and deflation topics based on the Merdeka Curriculum.
3. The study involved Grade XI students at SMA Negeri 4 Sidoarjo as the trial sample.
4. The analysis was limited to feasibility, practicality, effectiveness, and student responses.
5. No comparison with other learning models was conducted, as the study focused on development and implementation only.

Future research is recommended to broaden the material scope, involve larger samples, and compare POE-based E-LKPD with other instructional models to improve generalizability.

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