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Development and Evaluation of an Educational Monopoly Game for Elementary School Students' Argumentative Thinking Skills in Natural and Social Sciences Learning

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Abstract*. This study aimed to develop and evaluate an educational Monopoly game designed to support third-grade students' argumentative thinking skills in learning about biotic and abiotic components. The research employed a Research and Development (R&D) approach using the ADDIE model, comprising Analysis, Design, Development, Implementation, and Evaluation. The study involved 43 third-grade students from two elementary schools in Gresik, Indonesia, consisting of 16 students in the limited trial and 27 students in the extended trial. A one-group pretest–posttest design was employed, with data collected through expert validation, teacher and student questionnaires, argumentative thinking tests, and classroom observations. Data were analyzed using descriptive statistics, normalized gain (N-Gain), and paired-samples t-tests. The results showed that the educational Monopoly game achieved material and media validity scores of 92.44% and 94.67%, respectively. Teacher and student practicality assessments yielded 97.33% and 92.34%, respectively. In the limited trial, the mean score increased from 50.38 to 88.69, with an N-Gain of 0.77. Similarly, the extended trial showed an increase from 50.96 to 87.15, with an N-Gain of 0.72. Both trials demonstrated statistically significant pretest–posttest differences ($p < .001$). Classroom observations also indicated improvements in students' abilities to formulate claims, provide supporting evidence, and respond to alternative viewpoints. These findings suggest that the educational Monopoly game is a promising instructional medium for supporting argumentative thinking in elementary science education, although causal conclusions remain limited by the absence of a control group.*

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Introduction

Natural and Social Sciences is an important subject in elementary education that helps students understand natural phenomena and their surrounding environment through reasoning, questioning, observation, experimentation, and communication (Elvianasti et al., 2022). IPAS learning is not solely oriented toward conceptual mastery but also encompasses scientific processes involving attitudes, processes, products, and applications (Trianto, 2010). Therefore, IPAS learning has the potential to develop students' thinking skills, including argumentative thinking. This potential can be

optimized through instructional strategies and learning media that provide opportunities for students to participate actively in expressing opinions and presenting logical explanations (Sastafiana et al., 2024).

Argumentative thinking skills refer to students' ability to express opinions supported by relevant reasons or evidence to justify a particular claim. These skills are essential because they help students understand concepts, develop critical thinking, and communicate ideas logically. Argumentative skills are closely associated with the ability to express opinions based on supporting reasons and evidence (Kharisma et al., 2025). Argumentation activities also contribute to the development of critical thinking skills and facilitate students' understanding of scientific concepts (Wahyunan Widhi et al., 2021). Furthermore, argumentation provides opportunities for students to defend or challenge opinions using logical reasoning and relevant evidence (Triananda et al., 2023). Thus, argumentative thinking skills need to be developed through learning activities that encourage students to express opinions, provide explanations, and respond to alternative perspectives.

The development of argumentative thinking skills is closely related to learning environments that allow students to construct knowledge through experience and social interaction. According to constructivist theory, students develop their understanding through active processes involving experiences and the assimilation or accommodation of new information (Piaget, 1973). Social constructivist theory emphasizes that knowledge construction also occurs through interaction, communication, and collaboration with others (Vygotsky, 1978). In educational settings, these interactions can be facilitated through discussions and exchanges of ideas that encourage students to formulate and defend arguments. Argumentation plays an important role in science learning as a means of developing logical thinking and constructing scientific explanations (Minin & Fauziah, 2022). Moreover, learning environments that provide opportunities for students to analyze information and formulate claims supported by strong reasoning are essential for developing argumentative thinking skills (Tiara & Az Zahra, 2023). Therefore, learning activities should be designed not only to facilitate the acquisition of information but also to provide opportunities for students to construct, justify, and evaluate arguments.

In this study, argumentative thinking skills are conceptualized through three components adapted from Toulmin's argumentation model: claim, data, and rebuttal. Toulmin's model explains that an argument consists of interconnected components that contribute to the construction of accountable reasoning (Toulmin, 2003). However, the present study focuses specifically on students' ability to express opinions (claim), provide supporting reasons or evidence (data), and respond to or challenge opposing opinions (rebuttal). The selection of these three components considers the developmental characteristics of third-grade elementary school students and the instructional needs identified in the research setting. These components also provide a foundation for designing learning activities that encourage students not only to answer questions but also to explain the reasoning underlying their responses.

However, preliminary observations conducted at three elementary schools revealed that existing instructional practices had not fully supported the development of students' argumentative thinking skills, particularly at UPT SD Negeri 216 Gresik. Classroom instruction was predominantly characterized by teacher-centered explanations and textbook-based learning, while the use of interactive instructional media remained limited. Consequently, students had relatively few opportunities to participate in

discussions, express opinions, and defend their answers using relevant evidence. An initial assessment of argumentative thinking skills revealed a class mean score of 68.00, which was below the school's minimum mastery criterion of 75. Furthermore, only approximately 20% of students were able to provide answers accompanied by logical explanations, while most students gave brief responses without adequate justification. These findings are consistent with research highlighting students' difficulties in constructing arguments supported by relevant reasons and evidence (Kusuma, 2025). These conditions indicate the need for more active learning approaches supported by instructional media that facilitate structured argumentation.

Biotic and abiotic components constitute a relevant topic within IPAS learning for developing argumentative thinking skills. In studying this topic, students are expected not only to identify and classify environmental components but also to justify their classifications based on observable characteristics. The ability to provide explanations and interpret phenomena using relevant evidence is important in IPAS learning (Zakaria, 2026). Preliminary observations indicated that some students were able to identify examples of biotic and abiotic components but experienced difficulties explaining the reasoning underlying their classifications. Students were also not fully accustomed to responding to their peers' opinions using logical explanations. Therefore, biotic and abiotic components offer an appropriate learning context for encouraging students to formulate claims, provide supporting reasons, and respond to alternative opinions through topics closely related to their everyday experiences.

One alternative approach to addressing these instructional needs is the use of educational game-based learning media. Learning media play an important role in facilitating instructional content delivery, providing learning stimuli, and encouraging active student participation during classroom activities (Pretty, 2025). Play-based learning activities can also contribute to the development of creativity and critical thinking skills (Rahabav & Aihena, 2025). Accordingly, educational games can be utilized not merely as recreational activities but as instructional resources systematically designed to align with learning objectives and the developmental characteristics of elementary school students.

One educational game that can be adapted for instructional purposes is Educational Monopoly. This medium modifies the conventional Monopoly game by incorporating curricular content and learning activities that encourage students to engage actively in the learning process. Educational Monopoly media can create an enjoyable learning atmosphere while providing opportunities for students to express their ideas and opinions (Akbar et al., 2022). The development of an Educational Monopoly game focusing on the cultural diversity of North Sumatra has also produced a valid learning medium that was effective in improving students' knowledge (Lestari & Yusnaldi, 2024). Meanwhile, research on the Argument-Driven Inquiry model based on socio-scientific issues has demonstrated the relevance of argumentation-oriented activities in encouraging students to express opinions and provide evidence-based explanations (Dianti et al., 2023). These findings provide a foundation for developing instructional media that integrate educational games with structured argumentation activities.

Although Monopoly-based instructional media have been developed in various educational contexts, the studies reviewed in the original research indicate opportunities for developing a Monopoly game specifically designed to facilitate elementary school students' argumentative thinking skills. Educational games should not be limited to encouraging students to answer questions or recall concepts; they should also provide

opportunities to justify responses and evaluate alternative viewpoints. Therefore, the present study develops an Educational Monopoly game incorporating question cards, challenge cards, and information cards. The learning activities embedded in these cards are designed to support three components of argumentation: claim, data, and rebuttal. Through collaborative gameplay, students are provided with opportunities to express opinions, present supporting reasons, exchange ideas, and respond to their peers' answers. This instructional design is consistent with social constructivist theory, which emphasizes the role of interaction and communication in knowledge construction (Vygotsky, 1978).

Based on these considerations, this study aims to develop and evaluate an Educational Monopoly game designed to improve third-grade elementary school students' argumentative thinking skills in learning about biotic and abiotic components. The evaluation focuses on three principal aspects: (1) the validity of the developed medium based on expert assessments, (2) its practicality based on teacher and student responses, and (3) its effectiveness as indicated by changes in students' argumentative thinking performance through pretest–posttest assessments and classroom observations. The instructional medium was developed using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) and evaluated through limited and extended field trials. This study is expected to provide an alternative instructional medium for IPAS learning that supports active student participation and contributes empirical evidence regarding the use of educational games to develop argumentative thinking skills in elementary education.

Method

Research Design

This study employed a Research and Development (R&D) approach to develop and evaluate an Educational Monopoly game designed to support third-grade elementary school students' argumentative thinking skills in learning about biotic and abiotic components. The development process followed the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This model was adopted to provide a systematic framework for identifying instructional needs, designing learning resources, developing educational products, implementing learning activities, and evaluating the quality of the developed instructional medium (Sugiyono, 2013).

The developed medium was evaluated based on three main aspects: validity, practicality, and effectiveness. Product validity was assessed through expert evaluations, while practicality was measured using teacher and student response questionnaires. Effectiveness was examined based on changes in students' argumentative thinking performance before and after the implementation of the medium. The effectiveness assessment employed a one-group pretest–posttest design, represented as O_1–X–O_2, where O_1 refers to the initial assessment, X represents learning activities using the Educational Monopoly game, and O_2 indicates the final assessment. This design was applied separately in the limited and extended field trials. Since the study did not involve a control group or random assignment, the design was intended to identify changes in students' performance following the intervention rather than establish a definitive causal relationship.

Research Setting and Participants

The study was conducted at two public elementary schools in Gresik Regency, East

Java, Indonesia. A total of 43 third-grade students participated in the implementation stage. The limited field trial involved 16 students from UPT SD Negeri 218 Gresik, while the extended field trial involved 27 students from UPT SD Negeri 216 Gresik. The two groups were analyzed separately because they represented different stages of product implementation and evaluation.

The limited field trial aimed to examine the initial implementation of the Educational Monopoly game and identify aspects requiring improvement. Subsequently, the extended field trial was conducted to evaluate the developed medium with a larger group of students and obtain additional data concerning its practicality and effectiveness. Product evaluation also involved three validators who assessed the instructional materials and media characteristics. Classroom teachers and participating students provided responses regarding the practicality of the developed medium during learning activities.

Development Procedures

The Educational Monopoly game was developed through the five stages of the ADDIE model.

Analysis

The analysis stage was conducted to identify instructional problems, curriculum requirements, student characteristics, and relevant learning materials. Data were collected through preliminary classroom observations, discussions with teachers, and initial assessments of students' argumentative thinking skills. The findings indicated that classroom instruction was predominantly characterized by teacher explanations and textbook-based learning, while opportunities for students to justify their answers and respond to alternative viewpoints remained limited. Curriculum analysis focused on the learning outcomes and objectives of Natural and Social Sciences (*Ilmu Pengetahuan Alam dan Sosial*, IPAS) in Phase B of the Merdeka Curriculum. Meanwhile, content analysis identified the characteristics, classification, and relationships of biotic and abiotic components as the main instructional materials to be incorporated into the Educational Monopoly game.

Design

The design stage involved preparing the instructional materials, game structure, visual elements, and learning activities to be integrated into the Educational Monopoly game. The medium was designed as a physical board game consisting of 32 spaces arranged around the playing board. These spaces incorporated illustrations of biotic and abiotic components, question spaces, challenge spaces, information-card spaces, and several conventional Monopoly elements. The medium was equipped with three types of instructional cards: question cards, challenge cards, and information cards. Question cards were designed to encourage students to express opinions and provide supporting reasons. Challenge cards were intended to facilitate discussions and responses to alternative viewpoints. Meanwhile, information cards contained brief explanations of relevant concepts to support students' understanding. The learning activities were structured around three selected components adapted from Toulmin's argumentation framework: *claim*, *data*, and *rebuttal* (Toulmin, 2003).

Development

During the development stage, the initial design was transformed into a physical instructional medium. The playing board was designed using Figma, while the

instructional cards and supporting visual elements were developed using Canva. The playing board was printed on a 150 × 150 cm banner and equipped with playing pieces, a die, instructional cards, and game instructions. The completed product underwent expert validation to assess content accuracy, instructional relevance, visual design, language suitability, readability, and ease of use. Three validators evaluated the developed medium using structured assessment instruments. Their comments and recommendations were used to improve the product, including revisions to the playing board illustrations, instructional content, card design, typography, and clarity of the game instructions.

Implementation

The revised Educational Monopoly game was implemented through two field trials: a limited trial and an extended trial. In each trial, students initially completed a pretest and participated in an initial observation assessment to determine their argumentative thinking skills before using the developed medium. Subsequently, students participated in group-based learning activities using the Educational Monopoly game. During gameplay, students followed the game instructions, answered questions, discussed the reasoning underlying their answers, presented supporting evidence, and responded to their peers' opinions. Classroom observations were conducted to document the argumentative thinking skills demonstrated during the learning activities. After the learning activities, students completed a posttest, while response questionnaires were administered to evaluate the practicality of the developed instructional medium.

Evaluation

The evaluation stage was conducted continuously throughout the development process and after product implementation. Feedback from validators, teachers, and students was used to identify the strengths and limitations of the developed medium. Quantitative data obtained through validation instruments, response questionnaires, pretests, posttests, and classroom observations were analyzed to evaluate product quality and changes in students' argumentative thinking performance.

Research Instruments and Data Collection

Data were collected using expert validation sheets, teacher and student response questionnaires, argumentative thinking tests, and classroom observation sheets. Qualitative data consisted of comments, suggestions, and recommendations obtained during product evaluation, whereas quantitative data included validation scores, user responses, test scores, and observation ratings. The expert validation instruments consisted of two structured assessment sheets, each containing 15 items. The media validation instrument assessed visual design, language, game instructions, typography, and media characteristics. Meanwhile, the material validation instrument evaluated instructional relevance, content accuracy, material presentation, instructional effectiveness, and language suitability. Each item was rated using a five-point Likert scale ranging from 1 (very poor) to 5 (very good).

Product practicality was assessed using separate teacher and student response questionnaires, each consisting of 15 items rated on a five-point Likert scale. The teacher questionnaire covered media appearance, instructional content, language, ease of use, and perceived instructional benefits. Meanwhile, the student questionnaire addressed ease of use, visual attractiveness, conceptual understanding, argumentative participation, learning engagement, motivation, and overall learning experiences. Students' argumentative thinking performance was assessed using pretests and posttests, each

consisting of 10 constructed-response questions related to biotic and abiotic components. The assessment instruments included questions measuring students' ability to identify and classify concepts, as well as tasks requiring them to express opinions, provide supporting reasons, and respond to alternative statements. The assessment framework incorporated three indicators of argumentative thinking: *claim*, *data*, and *rebuttal*. Students' responses were evaluated using scoring guidelines that considered the completeness and accuracy of their explanations.

Classroom observations were conducted using an analytical rubric consisting of three argumentative thinking indicators: *claim*, *data*, and *rebuttal*. Each indicator was rated on a four-point scale ranging from 1 (poor) to 4 (very good). The *claim* indicator assessed students' ability to express relevant statements or opinions, the *data* indicator measured their ability to provide logical supporting reasons or evidence, and the *rebuttal* indicator evaluated their ability to respond to or challenge alternative opinions using appropriate reasoning. Initial observations were conducted before the intervention, while subsequent observations documented students' argumentative thinking performance during learning activities using the Educational Monopoly game.

Data Analysis

Quantitative data were analyzed using descriptive statistics, percentage calculations, normalized gain (N-Gain) analysis, and statistical significance testing. Meanwhile, qualitative data consisting of comments and recommendations from validators and users were analyzed descriptively to identify aspects requiring improvement in the instructional content and media design. Validity and practicality percentages were calculated by dividing the total obtained scores by the maximum possible scores and multiplying the results by 100%. The resulting percentages were interpreted according to the assessment criteria established in the research instruments. For product validity, percentages ranging from 86% to 100% were categorized as very valid, whereas percentages ranging from 71% to 85% were categorized as valid. The corresponding categories for practicality assessments were very practical and practical, respectively. Changes in students' performance were analyzed by comparing pretest and posttest scores and calculating normalized gain (N-Gain). N-Gain analysis was employed to determine the proportion of the maximum possible improvement achieved by students (Hake, 1998). The N-Gain value was calculated using the following equation:

$$g = \frac{S_{\text{posttest}} - S_{\text{pretest}}}{S_{\text{maksimum}} - S_{\text{pretest}}}$$

Keterangan:

- g = N-Gain value
- S_{posttest} = Score after using the instructional medium
- S_{pretest} = Score before using the instructional medium
- S_{maksimum} = Maximum possible score (100)

N-Gain values were classified into three categories: low ($g \leq 0.30$), moderate ($0.30 < g \leq 0.70$), and high ($g > 0.70$). The analysis was conducted separately for the limited and extended field trials. Statistical analysis was performed using IBM SPSS Statistics version 24. The initial analysis included Shapiro–Wilk normality tests on pretest and posttest score distributions and Levene's test for homogeneity of variance. Differences between

pretest and posttest scores were examined using paired-samples t-tests at a significance level of 0.05. For paired-samples comparisons, the relevant normality assumption concerns the distribution of within-student score differences rather than the separate pretest and posttest distributions. Therefore, the normality of paired differences also needed to be considered when interpreting the statistical results. A two-tailed *p*-value below 0.05 was used as the criterion for identifying statistically significant differences between the paired measurements.

Classroom observation data were analyzed descriptively by converting the obtained rubric scores into percentages of the maximum possible scores. The observation percentages were classified into five categories: very good (81–100%), good (61–80%), fair (41–60%), poor (21–40%), and very poor (0–20%). The observation results were used to complement the test findings by describing students' demonstrated abilities to formulate claims, provide supporting evidence, and respond to opposing arguments during the learning activities.

Results and Discussion

Results

This study developed an Educational Monopoly game designed to support the improvement of third-grade elementary school students' argumentative thinking skills in learning about biotic and abiotic components. The product was developed using the ADDIE model, which comprises Analysis, Design, Development, Implementation, and Evaluation. Each stage generated findings that informed the subsequent stage. The research findings are presented according to these five development stages.

Analysis Stage

The analysis stage was conducted to identify instructional problems, curriculum requirements, students' learning needs, and the characteristics of the instructional content to be incorporated into the Educational Monopoly game. The findings of this stage provided the basis for determining the format of the medium, instructional content, and argumentation activities appropriate for third-grade elementary school students. The results of the preliminary classroom observations and argumentation-based constructed-response assessments at UPT SD Negeri 216 Gresik indicated that IPAS instruction was predominantly conducted through lectures, textbooks, and student worksheets. The use of interactive learning media that encouraged active student participation remained limited. This condition was reflected in students' passive participation, limited confidence in expressing opinions, and difficulties explaining the reasons or evidence supporting their answers. The preliminary assessment revealed a mean argumentative thinking score of 68.00, with approximately 20% of students able to provide answers accompanied by logical explanations.

The curriculum analysis indicated that the target schools implemented the Merdeka Curriculum. The development of the instructional medium was aligned with the learning outcomes and objectives of Natural and Social Sciences (*Ilmu Pengetahuan Alam dan Sosial*, IPAS) in Phase B, particularly the topic of biotic and abiotic components. The analysis identified that this topic could be explored through observation, classification, explanation of characteristics, and discussions concerning relationships among environmental components. These activities provided opportunities for students to connect conceptual understanding with the ability to construct evidence-based explanations.

The analysis of students' learning needs was conducted through classroom observations and interviews with third-grade teachers. The findings indicated that students were interested in learning activities involving games, discussions, and direct interactions with their peers. Students also tended to demonstrate greater enthusiasm when instruction incorporated engaging activities that encouraged active participation. These findings supported the selection of a Monopoly-based instructional medium that could facilitate learning through questions, challenges, and group discussions. Meanwhile, the content analysis identified several essential learning topics, including the definitions, examples, characteristics, differences, and relationships of biotic and abiotic components. The instructional content was adapted to the learning abilities of third-grade students and oriented toward three indicators of argumentative thinking: *claim* (expressing an opinion), *data* (providing reasons or evidence), and *rebuttal* (responding to or challenging an opinion). Overall, the analysis indicated a need for an interactive instructional medium that could facilitate conceptual understanding while providing students with opportunities to express and defend their opinions through gameplay and discussion.

Design Stage

The design stage produced the instructional content and initial design of the Educational Monopoly game based on the needs identified during the analysis stage. The instructional materials were organized systematically, beginning with the definitions and examples of biotic and abiotic components and progressing to activities that required students to distinguish their characteristics and explain relationships between the two components within the environment. The materials were aligned with the learning objectives of third-grade IPAS and transformed into questions and activities that could be incorporated into gameplay.

The instructional design also integrated the indicators of *claim*, *data*, and *rebuttal* into the game activities. The *claim* indicator was addressed through questions requiring students to provide answers or express opinions. The *data* indicator was incorporated through activities requiring students to present reasons or evidence supporting their answers. Meanwhile, the *rebuttal* indicator was integrated through activities involving responses to or challenges against alternative opinions. These activities were intended to encourage students not only to recall instructional content but also to develop reasoning skills through interaction during gameplay. The media design resulted in an Educational Monopoly storyboard illustrating the arrangement of the playing board, visual elements, game spaces, instructional cards, and supporting components. The playing board was designed in a square format with 32 spaces surrounding its central area. Each space was arranged according to the game sequence and instructional requirements. The medium incorporated three types of instructional cards: question cards, challenge cards, and information cards.

The question cards were designed to contain tasks encouraging students to provide answers supported by logical explanations. The challenge cards were intended to facilitate discussions, the expression of opinions, and responses to alternative viewpoints. Meanwhile, the information cards were designed to present concise explanations of biotic and abiotic components to support conceptual understanding. Playing pieces, a die, and game instructions were also included as supporting components.

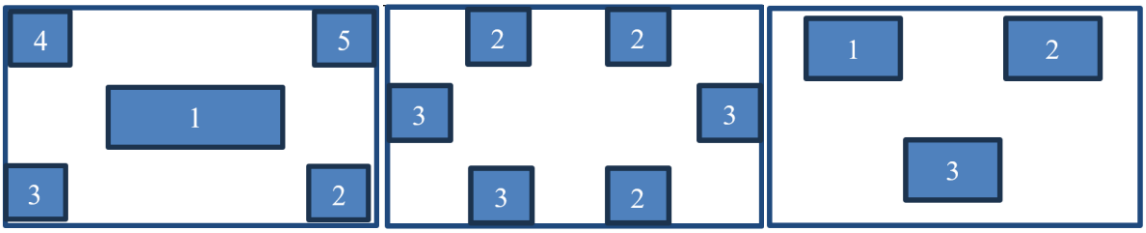


Figure 1. Initial Design (Storyboard) of the Educational Monopoly Game

The initial design was subsequently evaluated through discussions with the academic supervisor. The evaluation focused on the alignment between the instructional content, game structure, and objectives related to the development of argumentative thinking skills. The evaluation findings were then used to guide the product development stage.

Development Stage

The development stage involved transforming the initial design into a physical instructional product. The playing board was designed using Figma, while the question cards, challenge cards, information cards, and supporting visual elements were prepared using Canva. The playing board was printed on a 150 × 150 cm banner and equipped with 32 game spaces, playing pieces, a die, instructional cards, and game instructions. The developed product integrated the structure of a conventional Monopoly game with instructional content concerning biotic and abiotic components. Illustrations on the playing board were designed to represent the characteristics of the learning material, while the instructional cards incorporated activities intended to develop argumentative thinking skills. The game was designed for group-based learning, allowing students to participate in gameplay, answer questions, provide supporting reasons, and discuss opinions with their peers.





Figure 2. Final Educational Monopoly Game and Its Instructional Components

After the product had been developed, expert validation was conducted to assess the validity of its instructional materials and media characteristics before classroom implementation. Three validators, consisting of two elementary education lecturers and one elementary school teacher, participated in the assessment. Each validation instrument consisted of 15 items rated on a five-point scale, resulting in a maximum possible score of 75 for each validator. The validation results are presented in Table 1.

Table 1. Expert Validation Results of the Educational Monopoly Game

Validator	Material Validation Score	Media Validation Score
Validator 1	72	72
Validator 2	66	69
Validator 3	70	72
Total score	208	213
Maximum possible score	225	225
Validity percentage	92.44%	94.67%
Category	Very valid	Very valid

As presented in Table 1, material validation produced a total score of 208 out of a maximum possible score of 225, corresponding to a validity percentage of 92.44%. Meanwhile, media validation yielded a total score of 213 out of 225, equivalent to 94.67%. Both results were classified as very valid according to the assessment criteria established in the study. In addition to providing quantitative assessments, the validators recommended several improvements to the developed product. Regarding instructional materials, the recommendations included expanding and elaborating the content, refining the formulation of learning outcomes, organizing instructional objectives progressively, incorporating relevant illustrations, and adjusting the language to improve clarity and communication. These revisions were intended to ensure that the instructional materials were appropriate for third-grade students' developmental characteristics and the planned argumentation activities.

Regarding media characteristics, the recommended improvements included adjustments to text colors and visual contrast, increased readability of game instructions, and refinement of the central board illustrations to represent biotic and abiotic

components more clearly. The questions on the instructional cards were also realigned with the learning objectives, while the typography and text presentation were improved to enhance readability. The validation results and subsequent revisions produced an Educational Monopoly game with improved instructional content and visual presentation. The revised product was then implemented in the limited and extended field trials.

Implementation Stage

The implementation stage involved two field trials of the Educational Monopoly game with third-grade elementary school students. The limited trial was conducted at UPT SD Negeri 218 Gresik with 16 students, while the extended trial was conducted at UPT SD Negeri 216 Gresik with 27 students. Both trials followed procedures involving an initial assessment, instructional activities using the developed game, and a post-intervention assessment. During the limited trial, students initially completed a pretest and participated in classroom observations to assess their argumentative thinking skills before using the instructional medium. Subsequently, group-based learning activities were conducted using the Educational Monopoly game. Students followed the game rules, answered questions presented on the instructional cards, provided supporting reasons, and responded to their peers' opinions. After the learning activities, students completed a posttest, and their argumentative thinking skills were observed. The findings from the limited trial were used to evaluate the initial implementation of the medium before conducting the extended trial.

The extended trial followed similar procedures with a larger group of participants. A total of 27 students completed a pretest and participated in initial classroom observations before the instructional activities. Students then used the Educational Monopoly game during group-based learning involving question-answer activities, discussions, explanations, and responses to alternative opinions. Following the intervention, students completed a posttest, participated in classroom observations, and completed response questionnaires. The practicality of the developed medium was assessed through teacher and student response questionnaires in both field trials. The questionnaires were used to obtain evaluations of the media appearance, ease of use, clarity of instructional content, and overall learning experience. The practicality assessment results are presented in Table 2.

Table 2. Practicality Assessment Results of the Educational Monopoly Game

Respondents	Field Trial	Obtained Score	Maximum Score	Percentage
Teacher	Limited trial	73	75	97.33%
Teacher	Extended trial	73	75	97.33%
Students	Limited trial (n = 16)	1,126	1,200	93.83%
Students	Extended trial (n = 27)	1,852	2,025	91.46%
Teachers (combined)	Both trials	146	150	97.33%
Students (combined)	Both trials	2,978	3,225	92.34%

As shown in Table 2, the teacher response questionnaires produced a practicality percentage of 97.33% in both trials. Meanwhile, student responses yielded percentages of 93.83% in the limited trial and 91.46% in the extended trial. The combined student response percentage was 92.34%. Based on the established assessment criteria, these results were classified as very practical. In addition to the quantitative assessments, user responses indicated that the developed medium was positively received during the learning activities. Teachers provided favorable evaluations regarding its ease of use and

relevance to the instructional content, while students demonstrated interest in learning through gameplay. These findings reflected users' acceptance of the developed medium.mIn addition to assessing practicality, the implementation stage generated data on students' argumentative thinking performance through pretest and posttest assessments. Measurements were conducted separately for each field trial. The descriptive results and normalized gain (N-Gain) scores calculated from individual student data are presented in Table 3.

Table 3. Students' Pretest, Posttest, and Normalized Gain Results

Assessment Indicator	Limited Trial (n = 16)	Extended Trial (n = 27)
Mean pretest score	50.38	50.96
Mean posttest score	88.69	87.15
Mean score improvement	38.31	36.19
Mean N-Gain	0.77	0.72
N-Gain category	High	High
Students in the high category	11	15
Students in the moderate category	5	11
Students in the low category	0	1

As presented in Table 3, the limited trial showed an increase in the mean score from 50.38 on the pretest to 88.69 on the posttest. The mean score improvement was 38.31 points, with an N-Gain value of 0.77, categorized as high. Of the 16 students, 11 achieved high normalized gains, while five were classified in the moderate category. In the extended trial, the mean score increased from 50.96 to 87.15, representing an average improvement of 36.19 points. The N-Gain value was 0.72, also categorized as high. Among the 27 students, 15 achieved high normalized gains, 11 were classified in the moderate category, and one remained in the low category. Descriptively, both groups achieved higher mean posttest scores than pretest scores, although the magnitude of improvement varied among individual students. Students' argumentative thinking skills were also examined during the implementation stage through classroom observations covering *claim*, *data*, and *rebuttal*. Each indicator was assessed using a four-point rating scale, and the obtained scores were converted into percentages. The observation results calculated from individual ratings are presented in Table 4.

Table 4. Classroom Observation Results of Students' Argumentative Thinking Skills

Indicator	Limited Trial Before (%)	Limited Trial After (%)	Extended Trial Before (%)	Extended Trial After (%)
Claim	39.06	89.06	43.52	88.89
Data	35.94	89.06	36.11	87.96
Rebuttal	29.69	79.69	31.48	78.70
Overall	34.90	85.94	37.04	85.19

As presented in Table 4, the classroom observation results showed improvements in argumentative thinking skills across both field trials. In the limited trial, the overall percentage increased from 34.90% to 85.94%, while the extended trial showed an increase from 37.04% to 85.19%. Improvements were observed across all three argumentation indicators. In the limited trial, the *claim* and *data* indicators each reached 89.06% after the intervention, while *rebuttal* reached 79.69%. Similar findings were obtained in the extended trial, where *claim* reached 88.89%, *data* reached 87.96%, and *rebuttal* reached 78.70%. These results indicate that *rebuttal* achieved lower percentages than the other two indicators in both trials. Nevertheless, all three indicators showed increased percentages after the learning activities.

Evaluation Stage

The evaluation stage was conducted to assess the overall outcomes of the development and implementation of the Educational Monopoly game. Evaluation encompassed the assessments and revisions conducted throughout the development process, as well as the final analysis of product validity, practicality, and changes in students' argumentative thinking performance. The evaluation of the analysis stage indicated that the need for instructional media development was associated with the limited use of interactive learning resources and insufficient opportunities for students to practice argumentation during classroom learning. These findings informed the design of an instructional medium integrating biotic and abiotic components with activities involving *claim*, *data*, and *rebuttal*. The initial design was evaluated through discussions with the academic supervisor, while the developed product was evaluated and revised based on recommendations from expert validators.

The product evaluation results indicated that the Educational Monopoly game achieved material and media validity percentages of 92.44% and 94.67%, respectively. Both results were categorized as very valid. Meanwhile, the practicality assessment yielded teacher and student response percentages of 97.33% and 92.34%, respectively, which were categorized as very practical according to the study's assessment criteria. Changes in students' argumentative thinking performance were evaluated using pretest and posttest scores, N-Gain analysis, and classroom observations. The N-Gain results showed improvements categorized as high in both trials, with values of 0.77 in the limited trial and 0.72 in the extended trial. Classroom observations also indicated improvements across all argumentation indicators, although *rebuttal* remained lower than *claim* and *data* in the post-intervention assessments.

Statistical analyses were conducted to examine the significance of differences between pretest and posttest scores. The Shapiro–Wilk normality tests applied to paired score differences yielded significance values of 0.329 in the limited trial and 0.295 in the extended trial. Both values exceeded 0.05, indicating that the normality assumption for paired differences was not rejected. Paired-samples t-tests were then conducted. The statistical results reported in the latest manuscript are presented in Table 5.

Table 5. Statistical Analysis of Pretest and Posttest Scores

Statistical Indicator	Limited Trial	Extended Trial
Number of students	16	27
Mean score improvement	38.31	35.07
Standard deviation of paired differences	14.81	14.75
Shapiro–Wilk significance	0.329	0.295
t-value	10.346	12.355
Degrees of freedom (df)	15	26
Two-tailed significance	< 0.001	< 0.001
95% confidence interval	30.41–46.20	29.23–40.91

As shown in Table 5, the paired-samples t-tests indicated statistically significant differences between pretest and posttest scores in both field trials. In the limited trial, the result was $t(15) = 10.346$, $p < .001$, with a mean score improvement of 38.31 points. Meanwhile, the extended trial yielded $t(26) = 12.355$, $p < .001$, with a reported mean score improvement of 35.07 points. The 95% confidence intervals for both trials were entirely above zero, indicating positive mean differences between the pretest and posttest measurements.

The evaluation findings indicated that the Educational Monopoly game met the validity and practicality criteria established in the study and was associated with improvements in students' assessed argumentative thinking performance following implementation. These improvements were observed through written assessments and classroom observations in both field trials. However, because the effectiveness assessment employed a one-group pretest–posttest design without a control group, the findings cannot establish that the observed improvements were caused exclusively by the Educational Monopoly game.

Overall, the five ADDIE development stages resulted in an Educational Monopoly game that underwent needs analysis, instructional design, product development and validation, classroom implementation, and learning evaluation. The findings from these stages provide a basis for assessing the quality of the developed product and its potential application in supporting third-grade students' argumentative thinking skills when learning about biotic and abiotic components.

Discussion

The findings of this study indicate that the Educational Monopoly game developed for learning about biotic and abiotic components met the criteria for high validity and practicality and was associated with improvements in third-grade elementary school students' argumentative thinking performance. The medium was developed in response to instructional needs that emphasized opportunities for students to understand scientific concepts while practicing how to express opinions, provide supporting reasons or evidence, and respond to alternative viewpoints. The integration of these activities represents a distinguishing characteristic of the Educational Monopoly game in supporting learning oriented toward argumentative thinking skills.

The development process began with a needs analysis indicating that the use of interactive instructional media remained limited and that students required more opportunities to express opinions supported by logical explanations. The preliminary assessment revealed a mean argumentative thinking score of 68.00, with approximately 20% of students able to provide answers accompanied by logical reasons. These findings provided the basis for designing a Monopoly game consisting of 32 spaces and three types of instructional cards: question cards, challenge cards, and information cards. The game activities were designed to integrate three indicators of argumentative thinking: *claim*, *data*, and *rebuttal*.

Validity of the Educational Monopoly Game

The validation results indicated that the Educational Monopoly game obtained a material validity percentage of 92.44% and a media validity percentage of 94.66%. Both results were classified as very valid. These findings suggest that the developed medium met the feasibility criteria established through expert assessments, particularly regarding the alignment of instructional content with learning objectives and the appropriateness of its visual presentation and media characteristics. This finding is consistent with, who emphasized the importance of aligning instructional media with learning objectives. The validity of the instructional materials was supported by the accuracy of concepts related to biotic and abiotic components, the alignment between instructional content and learning objectives, and the use of language appropriate for third-grade students (Wulandari et al., 2023). Meanwhile, media validity was supported by the design of the

playing board, readability of written materials, clarity of game instructions, and ease of use. During the validation process, the validators recommended several improvements, including revisions to the formulation of learning objectives, adjustments to instructional content, improvements in visual contrast, and more detailed game instructions. These recommendations were incorporated into the revised product before field implementation. Thus, the validation process not only established the feasibility of the developed medium but also provided a foundation for improving the product to better meet instructional needs.

Practicality of the Educational Monopoly Game

The questionnaire results indicated that teacher responses reached 97.33% in both the limited and extended trials, while the combined student response percentage was 92.34%. All results were categorized as very practical. These findings suggest that the developed medium was positively received by users based on the assessed aspects, including ease of use, visual presentation, relevance of instructional content, and implementation of learning activities. The Educational Monopoly game was equipped with a playing board, playing pieces, a die, question cards, challenge cards, and information cards. These components enabled students to learn through gameplay and group discussions. The instructional cards also provided opportunities for students to express opinions, present supporting reasons, and respond to their peers' viewpoints. This finding is consistent with, who discussed the use of Monopoly-based instructional media to support learning through play (Mahesti & Koeswanti, 2021). Nevertheless, favorable user responses primarily reflect the acceptance and usability of the developed medium. Therefore, practicality should be distinguished from effectiveness, which was examined through test scores and classroom observations.

Effectiveness of the Educational Monopoly Game

The effectiveness of the Educational Monopoly game was examined through pretest and posttest scores, N-Gain analysis, paired-samples t-tests, and classroom observations of students' argumentative thinking skills. In the limited trial, the mean score increased from 50.38 on the pretest to 88.69 on the posttest, with an N-Gain of 0.77, equivalent to approximately 77%, and categorized as high. Similarly, the extended trial showed an increase in the mean score from 50.96 to 87.15, with an N-Gain of 0.72, equivalent to approximately 72%, also categorized as high. These results indicated that both groups demonstrated improvements in their assessed argumentative thinking performance following the implementation of the Educational Monopoly game. The paired-samples t-tests yielded significance values of $p < .001$ in both field trials, indicating statistically significant differences between pretest and posttest scores. The Shapiro–Wilk normality tests also produced significance values above 0.05 for the paired score differences in both trials. These findings provide statistical evidence of changes in students' assessed performance after the instructional intervention.

The improvements in students' performance may be understood in relation to the instructional activities embedded within the game. Question cards and challenge cards encouraged students to express opinions (*claim*), provide supporting reasons or evidence (*data*), and respond to alternative viewpoints (*rebuttal*). These activities corresponded to the argumentative thinking indicators adopted in the study. Explained that the structure of an argument involves relationships between claims and the supporting elements used

to justify them (Toulmin, 2003). Within the present instructional context, students were provided with opportunities to express opinions based on their understanding of the learning material and present reasons supporting their answers.

The classroom observation results further indicated improvements in argumentative thinking skills during the learning activities. In the limited trial, the overall observation percentage increased from 34.90% to 85.94%, while the extended trial showed an increase from 37.04% to 85.19%. These findings complemented the written assessment results by providing information about students' argumentative thinking performance during classroom activities. The test results reflected changes in students' assessment scores, whereas classroom observations provided additional evidence concerning the argumentative behaviors demonstrated during gameplay and group discussions.

Overall, the N-Gain results, statistical comparisons, and classroom observations demonstrated positive changes following the implementation of the Educational Monopoly game. Nevertheless, these improvements did not indicate that all students experienced changes of equal magnitude. The findings also require further investigation to explain differences in the development of individual argumentation indicators, including *claim*, *data*, and *rebuttal*. Therefore, the implementation of this instructional medium should continue to involve teacher guidance to ensure that students have sufficient opportunities to express opinions, provide supporting reasons, and respond to alternative viewpoints. Accordingly, the Educational Monopoly game has the potential to serve as an alternative instructional medium for integrating conceptual understanding of biotic and abiotic components with structured argumentative thinking activities in third-grade elementary school IPAS learning

Conclusion

This study developed an Educational Monopoly game focusing on biotic and abiotic components to support third-grade elementary school students' argumentative thinking skills. The validation results indicated that the developed medium achieved a material validity score of 92.44% and a media validity score of 94.66%, both categorized as very valid. The practicality assessment also demonstrated positive responses from teachers and students, with scores of 97.33% and 92.34%, respectively, indicating that the developed medium was highly practical for classroom use. The findings demonstrated improvements in students' assessed argumentative thinking performance following the implementation of the Educational Monopoly game. In the limited trial, the mean score increased from 50.38 to 88.69, with an N-Gain of 0.77. Similarly, the extended trial showed an increase in the mean score from 50.96 to 87.15, with an N-Gain of 0.72. Both N-Gain values were classified as high. The paired-samples t-tests also revealed statistically significant differences between pretest and posttest scores. Furthermore, classroom observations indicated improvements in students' argumentative thinking skills, including their abilities to formulate claims, provide supporting reasons or evidence, and respond to alternative viewpoints. Based on these findings, the Educational Monopoly game met the established criteria for high validity and practicality and was associated with improved argumentative thinking performance among third-grade students learning about biotic and abiotic components. The developed medium offers a promising alternative for IPAS instruction by integrating conceptual understanding with argumentation activities through educational gameplay and group discussions.

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