

Development of Interactive Learning Media Using Lumio by SMART to Improve Students' Motivation in Learning Dynamics

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Abstract

This study aims to develop interactive learning media using Lumio by SMART on the topic of Dynamics to enhance students' learning motivation. The study employed a Research and Development (R&D) method using the ADDIE model and involved 38 eleventh-grade students. The expert validation results indicated that the developed media achieved a high level of validity, with an average score of 92.78%. Students' responses were also highly positive, with an average percentage of 95.3% in terms of visual design, content presentation, and perceived benefits. Students' learning motivation was measured before and after the implementation of the media and analyzed using the N-gain formula. The findings revealed a substantial improvement in learning motivation, with an average N-gain score of 0.91, which is classified as high, and the increase was observed across all ARCS motivation components: attention, relevance, confidence, and satisfaction. Overall, these findings indicate that the Lumio by SMART-based interactive learning media is valid, effective, and well received by students, making it a promising innovative approach to enhancing learning motivation and improving the quality of physics instruction in senior high schools.

Keywords: *Interactive learning media, motivation, Lumio by SMART, Physics education, Research and Development*

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1. INTRODUCTION

Physics education aims to improve students' understanding of scientific concepts and their logical and analytical thinking skills. However, in practice, physics education is often considered difficult, especially when it comes to the abstract subject of motion dynamics, which involves many mathematical formulas. This situation has a negative impact on student motivation and participation in learning activities. Students tend to lack interest in studying physics because they feel that the subject is uninteresting, difficult to understand, and dominated by numbers and formulas without supporting visualizations (Vuztasari & Diyana, 2024). results of a systematic literature review conducted by (Muhammad Sidik et al., 2024), shows that physics is often viewed as an abstract and challenging subject, so conventional teaching methods that lack visualization are less able to optimally increase student motivation and engagement. This shows that physics is often considered an abstract and difficult discipline, so teaching methods that lack visualization are unable to maximally increase student motivation and engagement. A systematic literature review by (Maharani et al., 2024), media that display images, animations, and videos can help students build mental images of the physics concepts being studied, thereby encouraging student activity, curiosity, and engagement in learning. In fact, visual media are not just tools to facilitate conceptual understanding: students can pay better attention to the information presented in these media and remember it much better than information received verbally (June, 2020). Technology-based interactive learning media has been proven to increase student motivation and engagement through more effective visualization and interaction (Asari et al., 2022). However, the use of interactive media in physics education in schools is still not optimal, and learning tends to be dominated by lecture methods with less interactive media (Harahap & Napatipulu, 2023).

Learning designed from a deep learning perspective prioritizes encouraging active participation from students. Deep learning involves balancing and exploring concepts, making connections and relationships with familiar concepts, and using knowledge in learning categories and contexts for thinking, wisdom, and other larger situations. Unlike rote memorization of core concepts, deep learning attempts to provide a meaningful conceptual foundation to enable thinking about important issues, critical thinking, and reflecting on and feeling learning experiences (Fullan dkk., 2018). In the context of developing digital teaching materials, the integration of deep learning principles is considered effective for developing students' 21st-century skills. In the context of Motion Dynamics, the deep learning approach is relevant because it helps students build conceptual understanding through the exploration of real phenomena directly related to everyday life. One learning model that is in line with deep learning principles is Problem-Based Learning (PBL). PBL places contextual problems as the starting point of learning, encouraging students to actively seek information, discuss, and build knowledge independently. PBL is effective in improving conceptual understanding and higher-order thinking skills because students are directly involved in the problem-solving process. The effectiveness of PBL combined with digital media in increasing learning motivation and student engagement in physics learning. In this study, deep learning principles and the PBL model were explicitly embedded in the design of the Lumio-based interactive media. The learning activities were structured according to the PBL stages, beginning with problem orientation through real-life motion phenomena presented in interactive videos, followed by collaborative discussion using the "Shout It Out" feature, guided investigation through interactive tasks, and reflection activities at the end of the lesson. These features were designed to promote conceptual exploration, critical thinking, and active student participation, which are central to deep learning principles.

One of the digital learning media that has the potential to support interactive learning is Lumio by SMART. Lumio by Smart is a digital learning media platform designed to increase student interactivity and engagement in the teaching and learning process. The platform allows teachers to deliver teaching materials, evaluate students' comprehension, and conduct quizzes and share learning videos in one integrated app (Sukinarti et al., 2024). Lumio is a web-based learning that provides a variety of interactive features, such as dynamic presentations, image and video presentations, formative quizzes, gamification, and real-time collaboration. In addition, Lumio is also equipped with *Shout It Out* which allows students to convey their responses, ideas, and feelings directly during the learning process. Several studies have shown that the use of Lumio is valid and practical and has the potential to increase students' motivation to learn. According to (Suharni, 2021), motivation is a change in energy in a person's personality that is characterized by the emergence of affective and reaction to achieve goals. However, the use of Lumio's interactive features in physics learning, especially in abstract Motion Dynamics materials, is still limited and has not been optimally utilized to increase students' activeness and motivation to learn.

Based on the results of initial observations, it is known that schools already have adequate ICT facilities and infrastructure, such as computers, projectors, and stable internet access, so as to support the implementation of digital-based interactive learning. The classroom condition has also supported the use of digital media with adequate electrical facilities and learning environment. Teachers and students are used to using digital facilities in learning, and have an open attitude towards the use of interactive learning media such as Lumio by SMART. Physics material, especially motion dynamics, has been taught in class XI in accordance with the applicable curriculum. So far, the learning media used is still limited to PowerPoint and modules, so it is necessary to develop more innovative interactive learning media to increase students' motivation to learn. Then interviews conducted with physics teachers showed that learning Motion Dynamics is still dominated by lecture methods using PowerPoint media and textbooks. This condition causes interaction between students and active involvement in learning to be low, so that students' motivation to learn has not developed optimally. The teacher stated the need for interactive learning media that is not only able to visualize physics concepts, but also encourages collaboration, direct interaction, and active participation of students in the learning process.

Although previous studies have reported the effectiveness of interactive media, deep learning approaches, and Problem-Based Learning in improving students' motivation and engagement, most of these studies have focused on general physics topics and primarily examined media feasibility or practicality. Limited research has specifically investigated the integration of Lumio by SMART in teaching Motion Dynamics while systematically measuring its impact on students' learning motivation

using the ARCS framework. Furthermore, few studies have combined deep learning principles and PBL within Lumio-based interactive media to address the abstract nature of dynamics concepts. Therefore, a clear research gap remains regarding how Lumio by SMART can be optimally designed and implemented to enhance students' motivation in learning Motion Dynamics.

Based on existing issues, it is necessary to develop interactive learning tools that can meet the demands of learning physics on the topic of Motion Dynamics. For this reason, this study aims to assess the extent to which the use of interactive learning tools based on Lumio by SMART on Motion Dynamics material can increase the learning spirit of grade XI students and evaluate students' responses to the use of Lumio by SMART. This research is expected to be able to contribute to the development of innovative learning tools and become an alternative option to improve the quality of physics learning at the school level.

2. METHODS

This study employs the Research and Development (R&D) methodology. The R&D approach is utilized for the creation of a specific product and to evaluate how effective that product is (Sari et al., 2025). The purpose is to design and assess the practicality of Lumio, which is an interactive learning tool based on SMART technology aimed at enhancing learning motivation among grade XI high school students studying Motion Dynamics. The development framework applied is ADDIE, which consists of the phases: Analysis, Design, Development, Implementation, and Evaluation. A visual representation of the ADDIE development model is illustrated in Figure 1.

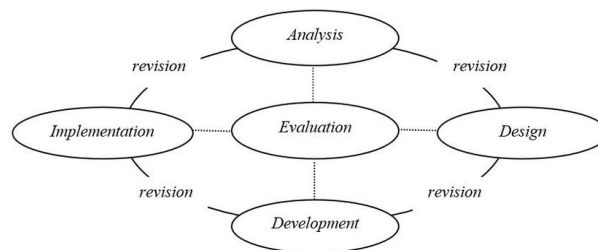


Figure 1. ADDIE development model scheme

The *analysis stage* is carried out to identify learning needs, student characteristics, the condition of school facilities and infrastructure, as well as problems faced in physics learning, especially in Motion Dynamics material. At this stage, data is collected through observation and interviews with physics teachers as well as the distribution of needs questionnaires to students. The *design stage* aims to design an interactive learning media based on Lumio by SMART. At this point, the tasks involved creating learning objectives, organizing media sequences, choosing appropriate materials, preparing engaging activities, and formulating research tools that encompassed expert validation surveys, questionnaires on learning motivation, and feedback forms for students. The development phase refers to the creation of educational media in line with the established design. The media is created utilizing the Lumio by SMART platform, incorporating a range of interactive elements, including visual presentations, gamification, assessments, and the Shout It Out feature. During this phase, experts also conduct validation to evaluate the suitability of the media, the motivation surveys, and the student feedback forms. The outcomes of this validation process inform the necessary revisions of the media.

The *implementation stage* was carried out by applying Lumio by SMART-based interactive learning media in learning physics of Motion Dynamics material in grade XI of SMA Negeri 2 Bengkulu City. At this point, learners utilize the created educational media, then complete a motivation survey prior to and following the learning process, along with a feedback survey after using the media. The assessment phase is conducted to evaluate how effective the educational media that has been created is. This evaluation involved examining the findings from expert validation, student feedback, and the enhancement of student motivation for learning, which is determined through normalized gain (N-gain) value calculations. The findings from this evaluation were utilized to formulate conclusions about the suitability and efficacy of Lumio, an interactive learning medium based on SMART principles.

The research design for the development of learning media was systematically prepared by utilizing Lumio by SMART as the main interactive learning medium in the Particle Motion Dynamics material. The learning media is developed in the form of Lumio interactive slides which integrate various supporting features, such as learning videos, gamification, *Shout It Out features*, and interactive evaluation features. In the design stage, the learning flow is structured based on *the Problem Based Learning (PBL)* syntax. The learning design begins with the presentation of triggering questions based on contextual phenomena through the initial display of Lumio as a means of orientation students to problems. Furthermore, learning materials are presented in stages through Lumio interactive slides that contain explanations of Newton's Law concepts, illustrations, and learning videos that are directly integrated into the media.

The investigation stage in learning design is facilitated through Lumio-based interactive activities, such as the presentation of experimental videos and videos of the application of Newton's Law in daily life, as well as gamification activities to encourage active involvement of students in exploring concepts. The *Shout It Out feature* is used as a means of discussion and expression of ideas, so that students can convey the results of their thoughts and hypotheses directly during the learning process. At the concept analysis and reinforcement stage, students are given practice questions and interactive quizzes that are compiled using the evaluation feature on Lumio, both in the form of multiple-choice questions and open-ended questions.

This research was carried out at SMA Negeri 2 Bengkulu City in the odd semester of the 2025/2026 school year, product development and validation were carried out at research institutions, while limited trials were carried out at SMA Negeri 2 Bengkulu City by considering the availability of supporting facilities and curriculum suitability. The research subjects totaled 41 people, consisting of 2 physics education lecturers as expert validators (academics), 1 physics teacher as practitioner validators, and 38 students of class XI SMA Negeri 2 Bengkulu City who were involved in a limited trial of the use of Lumio By Smart. Data collection techniques include observation, interviews, and questionnaires, while research instruments are in the form of observation sheets, interview guidelines, needs questionnaires, expert validation questionnaires, student response questionnaires, and learning motivation questionnaires.

Expert validation was carried out using likert four (Very Good, Good, Not Good, Very Not Good) whose level measured the feasibility of the media, response questions and motivation questions. The questionnaire also used a four-level Likert scale that aims to measure students' level of approval of statements in the questionnaire. The scoring criteria on the Likert scale can be seen in Table 1.

Table 1. Assessment Criteria

Criteria	Score
Strongly Agree (ST)	4
Agree (S)	3
Disagree (ST)	2
Strongly Disagree (STS)	1

The results of questionnaire data processing are analyzed in the form of percentages to facilitate the interpretation of research results. This percentage is used as a basis for determining the assessment category of learning media and student response. The assessment criteria based on percentage can be seen in Table 2.

Table 2. Scoring Criteria by percentage

Percentage	Category
0% - 25%	Strongly Disagree (STS)
26% - 50%	Disagree (TS)
51% - 75%	Agree (S)
76% - 100%	Strongly Agree (SS)

(Melianti et al., 2020)

The increase in students' learning motivation before and after the use of interactive learning media was analyzed using normalized gain (N-gain). Although normalized gain (N-gain) is commonly used

to measure cognitive learning outcomes, it can also be applied to pretest–posttest quantitative data to determine the magnitude of improvement in measured variables. In this study, students’ learning motivation was assessed using a Likert-scale instrument that produced numerical scores, allowing the calculation of N-gain to examine the extent of motivational improvement. Therefore, the use of N-gain in this research refers to measuring the relative increase in motivation scores before and after the intervention. Terjemahkan. N-gain analysis was used to determine the level of increased student learning motivation after the application of the developed learning media. The interpretation criteria for the N-gain value in this study are presented in Table 3.

Table 3. N-Gain Index Criteria

N-Gain	Category
$(g) > 0.7$	Height
$0.3 \leq (g) \leq 0.7$	Medium
$(g) < 0.3$	Low

(Ramdhani et al., 2020)

3. RESULTS AND DISCUSSION

The Process of Development and Feasibility of Learning Media

This research resulted in an interactive learning media innovation using Lumio by SMART for Motion Dynamics material, with the aim of increasing the learning spirit of grade XI students. The educational media is created following the phases of the ADDIE framework, which consists of Analysis, Design, Development, Implementation, and Evaluation. During the Analysis phase, an assessment of the requirements for physics education, the traits of the students, and the content of Motion Dynamics was conducted. The findings from this analysis indicate that classroom physics instruction has not completely adopted a student focused learning method and continues to be primarily centered around lectures, resulting in students being more passive and having lower motivation levels. Motion Dynamics material which is abstract and involves a lot of mathematical concepts requires learning media that is able to visualize concepts and actively involve students. Therefore, the use of Lumio by SMART was chosen because it provides interactive features that support student engagement in learning.

The Design stage aims to design learning media in a systematic and structured manner. At this stage, a media design was prepared that included learning flows, material presentations, and interactive activities that were adapted to the problem-based learning syntax. Media design is carried out so that students not only receive information, but also actively participate in the problem-solving process related to the phenomenon of Motion Dynamics, so that it can increase students' motivation to learn. Furthermore, in the Development stage, the media design was realized into an interactive learning media product based on Lumio by SMART. The media developed contains materials, examples of contextual problems, and interactive activities that encourage student participation. At this stage, validation is also carried out by material experts and media experts to assess the feasibility of the content, appearance, and suitability of the media for learning purposes. Input from the validators is used as a basis for revisions so that the media produced has better quality and is suitable for use in learning.

The Implementation stage is carried out through a limited trial for grade XI students. Learning media is used in physics learning activities to see the implementation of media use and students' initial responses. This implementation aims to find out whether the developed media can be used properly and is able to create a more interactive and interesting learning atmosphere. The last stage, namely Evaluation, is carried out to assess the quality and effectiveness of learning media as a whole. The evaluation was carried out based on the results of expert validation and student responses to the use of media. The results of the evaluation showed that Lumio by SMART-based interactive learning media met the eligibility criteria and had the potential to increase students' learning motivation in the Motion Dynamics material.

Based on the learning media development process through the ADDIE stage, media feasibility assessment is an important aspect to ensure that the media produced meets quality standards before

being widely used in physics learning. Data obtained from the results of expert validation, field trials were analyzed to evaluate the feasibility of learning media, to find out the increase in student learning motivation after participating in learning using interactive media and to find out how students responded to Lumio by SMART media.

The validation process was conducted to obtain expert feedback regarding the feasibility and quality of the Lumio by SMART-based interactive learning media. This process aimed not only to determine whether the product met feasibility criteria, but also to identify strengths and potential areas for improvement before its implementation in physics learning. Product validation ensures that the developed media meets standards in terms of content accuracy, presentation structure, language clarity, media design, and its potential to enhance learning motivation (Tri Saputra, 2024). Product validation was conducted to determine the validity and feasibility of the developed learning media. The feedback provided by experts was used as the basis for refining the product to ensure its appropriateness for physics learning. At this stage, validation was carried out on the learning media, the learning motivation questionnaire, and the student response questionnaire to assess content suitability, clarity of indicators, visual design, and ease of use. The validation results indicated that both the learning media and research instruments were categorized as “excellent,” and therefore were considered feasible for use in teaching Motion Dynamics. A summary of the validation results is presented in Table 4.

Table 4. Results of Expert Validation of Lumio By Smart Media

Assessment Aspects	Yield (%)	Number of Items	Remarks
Content Eligibility	90,63	8	Very Eligible
Presentation	94,44	3	Very Eligible
Language	89,58	4	Very Eligible
Media	92,59	9	Very Eligible
Motivation	96,67	5	Very Eligible
AVERAGE	92,78		Very Eligible

Based on the expert validation results presented in Table 4, the Lumio by SMART-based interactive learning media demonstrated a high level of feasibility for use in physics learning on the topic of Motion Dynamics for grade XI students. Expert assessments indicated that the developed media met the criteria in terms of content, presentation, language, media design, and motivational aspects. This suggests that the learning media is appropriate both in terms of conceptual substance and instructional design. In terms of content feasibility, the media presents Motion Dynamics material aligned with basic competencies, learning objectives, and students’ developmental characteristics. The alignment between curriculum objectives and interactive content design likely contributed to the high validation scores, as it ensures pedagogical relevance and instructional coherence. Furthermore, the relevance of the material supports students in understanding abstract physics concepts more effectively.

The presentation aspect shows that the learning media is organized systematically and sequentially, enabling students to follow the learning flow more easily. The structured presentation, combined with interactive activities and formative evaluations, likely contributed to increased student engagement, as learners were actively involved rather than passively receiving information. This is consistent with interactive learning principles that emphasize logical organization and active participation. From a linguistic perspective, the media uses clear, communicative language that complies with Indonesian language conventions. Physics terminology is presented accurately and in an accessible manner, reducing potential difficulties in understanding complex mathematical expressions and abstract concepts. In terms of media design, the visual layout, color selection, illustrations, and the use of Lumio by SMART’s interactive features support the learning process effectively. Visualizations through images, animations, and videos assist students in constructing conceptual understanding. Moreover, features such as real-time interaction encourage two-way engagement, transforming the learning experience into a more participatory process.

The motivation aspect obtained the highest validation score among all assessed components, indicating the strong potential of the media to attract students’ attention and enhance their learning motivation. This result may be attributed to the integration of interactive elements such as gamified visual simulations, and real-time participation features (e.g., Shout It Out), which stimulate curiosity and active involvement. These design elements align with Keller’s ARCS motivation model,

particularly the Attention and Relevance components, which are essential in fostering students' intrinsic motivation during the learning process.

The validation results are consistent with learning media development theory, which states that effective instructional media should meet criteria related to content, language, presentation, and visual design to function optimally in classroom settings. The high score in the motivation aspect further supports Keller's ARCS theory, emphasizing the importance of attention, relevance, confidence, and satisfaction in enhancing learning motivation. However, validators also provided minor suggestions regarding the clarity of certain instructions and the consistency of visual layouts. These recommendations indicate that although the media is considered feasible and of high quality, further refinement is necessary to optimize its implementation. The findings of this study are supported by previous research (Asyamsi et al., 2025) which demonstrates that well-designed interactive learning media can enhance students' motivation by creating more engaging learning experiences. Similarly, empirical evidence (Putri et al., 2022) suggests that media validated in terms of content, language, and presentation contributes to more effective material delivery and improved student engagement.

Student Response to the Media

In addition to the feasibility of media, another aspect of concern in this study is student response and increased learning motivation after the use of Lumio by SMART-based interactive learning media. To find out the students' responses to the use of Lumio by SMART-based interactive learning media, an analysis was carried out on student response data after participating in the learning process. Student responses were analyzed to assess aspects of media display, material presentation, and the benefits of media in supporting physics learning. The results of the analysis of student responses are presented in the following table.

Table 5. Student Response (n=38) to the Use of Lumio By Smart Media

Response Aspect	Average Percentage (%)	Number of Items	Category
Media Display	96	7	Excellent
Presentation	95	7	Excellent
Benefits	95	6	Excellent

Based on Table 5, the results of students' responses to the use of Lumio by SMART-based interactive learning media show a very positive assessment of all aspects assessed. The media display aspect obtained a percentage of 96% with the category *Excellent*, which indicates that students assess the visual design, layout, and graphic presentation of the media to be attractive and easy to understand. The aspect of presenting the material obtained a percentage of 95% with the category *Excellent*, which indicates that the material is presented in a systematic, clear manner, and supports the understanding of physics concepts. Meanwhile, the media benefit aspect also obtained a percentage of 95% with the category *Excellent*, which shows that students feel real benefits from the use of media in aiding the learning process. The average score of student responses was 95.3% with the category *Excellent* emphasized that Lumio by SMART-based interactive learning media can be very well received by students and is considered effective in supporting physics learning in the classroom. This positive response shows that the media developed is not only technically feasible, but also capable of creating a fun and meaningful learning experience for students.

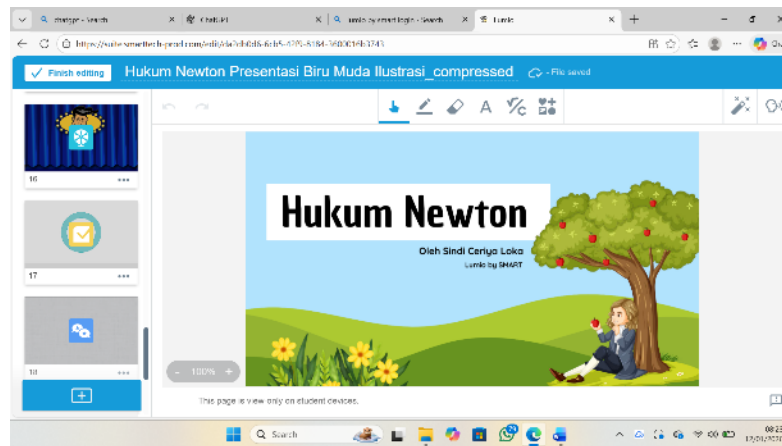


Figure 2. Lumio Media Display By SMART

Figure 2 shows the display of Lumio by SMART-based interactive learning media developed by adjusting the theme of physics learning, especially Newton's Law material. The cover display is designed with contextual and attractive visual illustrations, so that it is able to give a positive initial impression and increase students' attention from the beginning of learning. This simple but communicative visual design supports the results of student responses to the aspect of media display that obtained a very good category.

In addition to visual displays, this media is also equipped with various interactive features that support active student involvement during the learning process. Gamification features are used to increase students' interest and enthusiasm through learning activities that are challenging and fun. Furthermore, the evaluation feature is used to measure students' responses and understanding at the end of learning, so that students can reflect on the learning outcomes that have been achieved. This learning media also provides a *Shout It Out feature* that allows students to express their opinions, ideas, and feelings directly during the learning process. The existence of this feature encourages two-way interaction and increases student participation, so that learning is not only teacher-centered, but actively engages students. This is in line with the results of students' responses to the aspect of presentation and the benefits of media that obtained the category of excellent, because students felt that the media was easy to use, interesting, and helped them understand the Dynamics of Motion material better. Thus, an attractive media display supported by interactive features on Lumio by SMART is one of the main factors for the high positive response of students to the developed learning media.

This positive response is in line with the findings of previous research that shows that the use of technology-based interactive learning media has received a good response from students. Research by (Hasibuan et al., 2024) revealed that the interactive learning tools employed in social studies are well-received by students and enhance the motivation to learn among fifth-grade pupils at Madrasah Ibtidaiyah, as interactive media fosters student engagement in the educational experience. In addition, research by (Ihwana, 2025), discovered that utilizing interactive media in science education greatly boosts student motivation for learning and elicits favorable reactions from students throughout the educational process. The favorable reactions from students towards Lumio, which is an interactive learning medium based on SMART technology, demonstrate that this resource is effective in fostering a supportive and engaging environment that caters to students' learning preferences, making it a suitable alternative for physics instruction in grade XI.

Increased Student Learning Motivation

Learning motivation is an important aspect of physics learning because it acts as the main driver of student involvement in the learning process. Therefore, in this study, student learning motivation was measured before and after the use of Lumio by SMART-based interactive learning media on the Motion Dynamics material to determine the change in motivation level that occurred. Without motivation, it is impossible for students to have the will to learn, therefore, arousing motivation is one of the roles and duties of teachers in every learning process (Vivi Yuliantari, 2023), Student educational enthusiasm was assessed prior to and following the implementation of interactive learning tools

utilizing Lumio by SMART. This assessment of learning enthusiasm seeks to identify variations in the degree of student motivation after engaging in lessons with the created media. The findings from evaluating student learning enthusiasm demonstrated an improvement in every indicator of motivation, suggesting that the interactive learning tools based on Lumio by SMART effectively enhanced student motivation for learning. A summary of the findings regarding student learning enthusiasm is illustrated in the table below.

Table 6. Results of Improving Student Learning Motivation (n=38)

Average Score		<i>N-Gain</i>	Category
Before	After		
41,81	77,07	0,92	Height

Based on the data in Table 6, students' learning motivation showed a significant increase after the use of Lumio by SMART-based interactive learning media in the physics learning of the Dynamics of Motion material. This increase is reflected in the average value of students' learning motivation that changes from pre-learning to post-learning conditions, with an N-Gain value of 0.92 which is included in the high category. This high N-Gain value indicates that the learning media developed is very effective in increasing students' learning motivation. The high N-Gain score obtained is inseparable from the characteristics of Lumio by SMART-based interactive learning media which is able to present an active, visual, and meaningful learning experience. This media presents Motion Dynamics material through a combination of images, animations, videos, and interactive activities that allow students to observe, explore, and respond to the material directly. Such a learning process helps students build understanding gradually, thus encouraging higher engagement and motivation to learn than conventional learning.

In line with the theory of cognitive development (Piaget, 1972), which states that students at the high school level are at the formal operational stage, which is the stage where students are able to think abstractly, logically, and systematically if supported by concrete and visual learning experiences. Interactive learning media allows students to first see and observe physical phenomena, then relate them to mathematical concepts and equations. This process of "seeing-understanding-inferring" is in accordance with Piaget's principles of constructivism, where knowledge is actively constructed by students through interaction with the learning environment.

When reviewed based on the ARCS model learning motivation indicators by (Keller, 2010), the increase in student learning motivation occurs in all indicators. On the indicator *Attention* (Attention), interactive learning media is able to attract students' attention through attractive visual displays, animations, and interactive activities such as quizzes and direct response features. This makes students more focused and interested in learning from the beginning. On the indicator *Relevance* (relevance), the Dynamics of Motion material is presented with contextual examples related to daily life, so that students feel that the material learned has benefits and is related to real experiences. The presentation of relevant material helps students build the meaning of learning, which further has an impact on increasing learning motivation. Indicator *Confidence* (confidence) has also increased because learning media provides opportunities for students to interact directly, answer questions, and get feedback quickly. This activity helps students understand the material gradually and increases confidence in completing tasks and understanding physics concepts that were previously considered difficult. Furthermore, in the *Satisfaction* indicator, students feel learning satisfaction after successfully completing learning activities and understanding the Dynamics of Motion material through interactive and fun media. This learning satisfaction encourages students to be more motivated in participating in the next learning.

Thus, the high N-Gain value of student learning motivation is the result of the synergy between the characteristics of Lumio by SMART-based interactive learning media, learning approaches that are in accordance with the student's cognitive development stage according to Jean Piaget's theory, and the fulfillment of all ARCS learning motivation indicators. These findings show that interactive learning media is not only effective in increasing students' learning motivation quantitatively, but also provides a meaningful learning experience that meets the needs of students in abstract physics materials such as Motion Dynamics.

These results align with earlier studies showing that technology-driven interactive educational tools can enhance learners' motivation to study (Rahayu & Luswati, 2022) indicates that utilizing interactive educational tools greatly enhances the motivation for learning among children in elementary education, as it offers a more captivating and immersive learning environment for students. In addition, (Ali et al., 2025) demonstrated that engaging educational tools significantly enhance learners' enthusiasm and drive to study by offering immediate feedback and promoting active participation throughout the educational experience. Other research by (Purnomo et al., 2025), also found that the use of interactive media in learning strategies can increase students' overall motivation to learn, as media interactivity increases student engagement with the material and learning process.

The increase in student learning motivation produced in this study is in line with various previous results that confirm that technology-based interactive learning media is one of the effective approaches to spur learning motivation. To analyze the increase in student learning motivation in more detail, groupings were carried out based on the ARCS indicator of learning motivation which reflects aspects of attention, relevance, confidence, and satisfaction in learning. The details of the increase in motivation obtained by students for each indicator are calculated based on the before and after scores that have been converted into a scale of 0-100 and are presented in the following Table 7.

Table 7. N-Gain on each Student motivation indicator (n=38)

No Question	Indicator	Before Score	After Score	N-Gain	Category
1,2,3 5	Caution	50	95	0,90	Height
4,6,7,8,9	Relevance	54	97	0,93	Height
10-15	Confidence	50	98	0,96	Height
16-20	Satisfaction	55	94	0,87	Height

These results show that the learning media developed is able to increase student learning motivation evenly in all aspects of motivation. The increase in attention indicators shows that Lumio by SMART-based interactive learning media is able to attract students' interest and focus through visual displays, interactive activities, and the presentation of varied materials. Furthermore, the increase in relevance indicators indicates that the material presented through the media is felt to be in accordance with the learning needs of students and the context of physics learning, so that students better understand the benefits of the material learned. Indicators of self-confidence gain value *N-Gain* highest, which shows that learning media helps students feel more confident in understanding the concept of motion dynamics through the exercises and feedback provided. Meanwhile, an increase in learning satisfaction indicators shows that students feel satisfied and have a pleasant learning experience during the learning process.

These findings are in line with the ARCS theory of learning motivation put forward by Keller, which states that learning motivation can be increased if learning is able to meet four main components, namely *attention*, *relevance*, *confidence*, and *satisfaction*. Lumio by SMART-based interactive learning media has fulfilled these four components, so that it can optimally increase student learning motivation. According to the theory of learning motivation, increased student attention, relevance, confidence, and satisfaction will encourage higher learning engagement, which ultimately impacts improved learning outcomes. Student learning outcomes showed an increase in average scores after the use of Lumio by SMART-based interactive learning media. Based on the results of the evaluation, the average overall student learning outcomes were 91%, which is included in the very good category. This increase indicates that high learning motivation encourages students to be more active, focused, and involved in understanding the concept of Motion Dynamics, thus having a positive impact on the achievement of learning outcomes. Thus, the learning media developed not only affects the affective aspect in the form of learning motivation, but also has a positive impact on the cognitive aspect of students, even though the learning outcomes in this study act as supporting data.

The results of this study are also in line with the results of previous research which showed that the use of technology-based interactive learning media is able to increase students' learning motivation. Research by (Ariyanti et al., 2025), showing that the use of interactive digital media significantly increases the learning motivation of high school students because they are able to encourage active participation and student engagement through the presentation of engaging and responsive content to

students' learning needs. In addition, research by (Agustin et al., 2025) in science learning, it was also found that interactive multimedia based on animated videos increased students' learning motivation by creating a more enjoyable learning atmosphere and being able to maintain students' interest during learning. Research by (Eli Mulyani, 2025), also shows that increased learning motivation triggered by the interactive media used also has an impact on improving student learning outcomes, because students become more involved, understand the material more deeply, and are active in the learning process.

Thus, the increase in student learning motivation on each indicator shows that Lumio by SMART-based interactive learning media is effectively used in physics learning, especially in class XI motion dynamics material, because it is able to meet the aspects of learning motivation as a whole.

4. CONCLUSION

Drawing from the outcomes of the study and the discussions held, it is evident that the SMART-based interactive learning media, Lumio, created for the Motion Dynamics topic, is regarded as suitable for implementation in XI grade physics education. The appropriateness of the media is demonstrated through evaluations from experts who rated all assessment aspects including content suitability, presentation, language, media, and motivational aspects—as very good. This indicates that the media aligns with feasibility standards concerning material depth, design, and educational support functions. Furthermore, the application of Lumio by SMART-based interactive learning media has shown effectiveness in enhancing students' motivation toward learning. This is highlighted by the N-Gain analysis, which indicated high proficiency levels, alongside improvements in all indicators of the ARCS motivation model: attention, relevance, confidence, and satisfaction. These improvements are bolstered by the use of visual aids, animations, and engaging interactive tasks that promote active participation from students during lessons. Additionally, feedback from students regarding the media's usage falls within the very good category, reflecting that the developed media meets the requirements and learning preferences of students, allowing for a more captivating, enjoyable, and efficient educational environment conducive to grasping Motion Dynamics concepts.

ACKNOWLEDGMENTS

The writer conveys appreciation and thankfulness to the Almighty God for His kindness and blessings that enabled him to successfully finish this article. The creation of this piece has been greatly influenced by the assistance, direction, and encouragement from numerous individuals. As a result, the writer wishes to extend his thanks to: The Physics Education Study Program (FKIP) of the University of Bengkulu for providing opportunities, knowledge, and facilities to the author during his education until the completion of this article. To the supervisor who has provided guidance, direction, suggestions, and very meaningful input during the process of preparing this article. To the author's parents, who always provide prayers, support, motivation, and sincere sacrifices so that the author can complete the education and preparation of this article well.

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