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Canva-assisted Learning of Inquiry Sequences (LOIS)-based e-worksheet effectiveness

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Abstract: Education in Indonesia has undergone a transformation that was initially conventional but now necessitates the integration of technology. Materials for teaching that can aid students in learning are required. The purpose of this study is to explain how well the e-worksheet for learning dynamic fluid physics works. This research uses a modified ADDIE model for research and development. The viability of the e-worksheet is estimated using a learning accomplishment test. The subjects of this review were thirty understudies in class XI at SMA Negeri 5 Bandar Lampung. The side effect of the test shows that the feasibility of e-worksheets in the control class is low given the low rules of learning based on revelation learning. The effectiveness of e-worksheets in the experimental class is very high.
Keywords: e-worksheet; Canva; LOIS

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Introduction

The advancement of data innovation and the development of different sorts of intricate natural issues are future difficulties that should be confronted, specifically the difficulties of the 21st century (Gholami et al., 2016; Sengupta et al., 2013; Valeri & Baggio, 2021; Zhong et al., 2021). In this century, every individual must possess both hard and soft skills (Fernández-Arias et al., 2021; Hikamah et al., 2021; Khakurel & Porras, 2020; Nurtanto et al., 2020; Valeeva et al., 2020). Skills that every person needs to have in the 21st century: according to the NEA (2012), there are 18 types of 21st century skills that must be taught to every person. Learning and innovation skills, which include the four areas of critical thinking, communication, collaboration, and creativity, are one of these skills (Hamida & Desnita, 2021; Jalinus, 2021; Mutohhari et al., 2021).

Skills for learning in the 21st century face difficulties in development, which is why the government improved the 2006 curriculum to the 2013 curriculum (Fernandes, 2019; Kusumaningrum & Djukri, 2016). Changes to the 2013 educational plan have an objective, specifically understudy-focused instructive exercises where learning exercises are completed by applying dynamic, intelligent, and imaginative examples, and it is trusted that understudies will have better information, abilities, and mentalities in mastering (Dakhi et al., 2020; Zakiyah & Sudarmin, 2022). The curriculum for 2013 will employ a scientific approach (Darmaji et al., 2019; Krasnova & Shurygin, 2020; Rafiq et al., 2023; Roy & Uekusa, 2020; Sahin & Yilmaz, 2020).

One of the physical science materials that obliges learning exercises is fluid elements. This material is remembered as one of the physical science materials that plays numerous significant roles

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in our regular daily existence. In fact, students have not achieved many basic competencies in relation to the dynamic fluid material. In the meantime, there are a few reasons for this, including: 1) One of the materials that students struggle to master is dynamic fluid material. Both the continuity equation and Bernoulli's law, two fundamental principles of fluid dynamics, are difficult for students to apply (Schäfle & Kautz, 2019; Sholihat et al., 2017); 2) students frequently misinterpret dynamic fluid content by assuming that the fluid velocity is proportional to the fluid pressure (Hernández-Calderón et al., 2017; Sholihat et al., 2017; Suarez et al., 2017); the technique for learning dynamic fluid ideas in schools is as yet restricted to clarification and needs true application (Degner et al., 2022; Fathiah et al., 2015; Kusyanti, 2021). Consequently, a Learning Of Inquiry Sequences (LOIS)-based learning model is deemed appropriate for the application of dynamic fluid material.

LOIS is a learning action that emphasizes understudies researching and finding answers for issues that are shown with a few guidelines in a few learning steps and questions, so understudies gain new information in light of the consequences of their examinations. According to Wenning and Khan (2011), LOIS itself has six levels: discovery learning, interactive demonstration, inquiry lesson, inquiry laboratory, real-world applications, and hypothetical inquiry. Clarifications should be visible in Table 1.

Table 1. Actual practice at the inquiry level

Discovery Learning	Interactive Demonstrations	Inquiry Lesson	Inquiry Lab	Real-world Application	Hypothetical Inquiry
Low		⟵ Intelligence Expertise ⟶			high
Teacher		⟵ Locus of Control ⟶			Student

As shown in Table 1, if students' understanding of Intellectual Sophistication is moving in the right direction, they will need to think more creatively and have more control over their own learning. On the other hand, the teacher retains control over learning because students' levels of thinking remain low regardless of how far to the left they are in terms of intellectual sophistication.

According to the findings of an analysis of the needs of teachers conducted by researchers, 85 percent of teachers use teaching materials to support physics learning activities, but these materials only come in the form of packaged worksheets that are available for purchase. The teaching materials used did not help students overcome their difficulties in training hands-on, minds-on activity, and SPS in comprehending the concept of fluid dynamic material, as 89.75% of teachers stated that they had never used multimedia that could collaborate with the use of teaching materials.

Since the epidemic limits in-person learning, people must rely on hands-on and careful experimentation for SPS. This is due to the fact that diverse learning styles necessitate practical activities, that online tools are limited, that creating materials takes time and that face-to-face activities are not possible. As a result, we've switched to electronic learning. As a result, an e-students' worksheet is required, which provides a few exercises from the PhET Recreation program that can energize concerns at the level of action, thinking, and item creation. The students' worksheet, which applies learning based on the demands of the educational plan, can be accessed over the Internet.

Risnawati et al. (2013) have previously conducted research of this kind, specifically the outdoor physics learning process, in which students are encouraged to investigate the natural environment with the help of a contextual module and an inquiry-based learning model to enhance SPS. Prabandaru (2015), namely, traditional or lecture-based instruction necessitates an inquiry-based approach to encourage more active participation on the part of students, Aktamiş et al. (2016) connected the requirement for meta-examination to show how request-based science learning analyzes customary learning as far as scholarly accomplishment, science process abilities, and understudies' mentalities toward science, Yildirim et al. (2016) related to the lack of meta-synthesis regarding SPS in Turkey, which shows a crucial gap in the literature, so to avoid this, an inquiry-based model of learning is needed to see SPS and overcome student ambiguity. Some of these studies have been effective in the implementation of learning. However, none of these studies have reviewed the effectiveness of Canva-assisted LOIS-based teaching materials to train hand-on activities, minds-on activities, or SPS. Therefore, research is needed regarding the effectiveness of Canva-assisted LOIS-based teaching materials to train hand-on activities, minds-on activities, and SPS.

The instructional material is the LOIS-based e-students' worksheet, developed according to the inquiry-based learning model by Wenning and Khan (2011). The application of this teaching material is in Canva-assisted research, which includes links to Google Classroom, Youtube, and PhET Simulation. It is anticipated that the Canva-assisted LOIS model and teaching materials for training students in hand-on, minds-on, and SPS will be able to overcome issues in the field. It is possible to formulate the problems in this study on the basis of the previous problems' context. "How can the LOIS-based e-worksheet assisted by Canva be effective for training students' hand-on activities, minds-on activities, and SPS?" is the formulation of the study's problem. This study aims to develop an efficient LOIS-based e-worksheet that uses Canva to train students' minds-on activities, hand-on activities, and SPS based on the problem's formulation.

Method

This research used a modified ADDIE model for research and development. The advancement comprises five phases, to be specific: (1) investigation, (2) plan, (3) improvement, (4) execution, and (5) assessment. In this review, the e-worksheet was created in view of LOIS with the assistance of Canva. Interviews were conducted with students and instructors of the dynamic fluid physics course at several grade XI high schools in Lampung province for the needs analysis. At the planning stage, the e-worksheet was planned in light of the LOIS model markers with the assistance of Canva. During the development stage, good teaching materials that can be used in class were developed into e-worksheets. The e-worksheets were then confirmed by a number of specialists. The content, the material, and the design are the aspects that were evaluated. At SMA Negeri 5 Bandar Lampung, thirty students took the valid e-worksheet test. The exploration configuration utilized was a pretest-posttest control group plan. There were two research samples in this study: the control group, which did not receive any treatment, and the experimental group, which did receive treatment. The reasonability of the e-worksheet was assessed using a learning achievement test. The n-gain was then used to determine the exploration data gathered from the results of the pre-test and post-test (Hake, 2002). The reasonability of the e-worksheet was assessed using a learning achievement test. The n-gain was then used to determine the exploration data gathered from the results of the pre-test and post-test (Hake, 2002).

Observation sheets on the achievement of hands-on activity, minds-on activity, and SPS were used to determine the product's effectiveness based on students' responses after reading and studying the e-worksheet, which had been developed and analyzed using descriptive qualitative methods. The values' results were sought for the average and incorporated into assessment statements to determine the level of student response. The transformation of scores into assessment statements is shown in Table 2.

Table 2. Score Interpretation Criteria Response

Percentage	Criteria
0%-25%	Not ideal
26%-50%	Not ideal
51%-70%	Pretty ideal
71%-85%	Ideal
86%-100%	Very ideal

(Ratumanan & Laurens, 2011)

Results and Discussion

The e-worksheet was developed in accordance with the LOIS indicators, the measured variables (hands-on, minds-on, and SPS), and the 2013 curriculum in dynamic fluid material. It also includes activities that are in accordance with those variables. Dynamic fluid material is one of the relevant physical science materials in our regular daily existence. However, students have not yet achieved the basic competencies overall for dynamic fluid material. This is due to a number of factors, including: 1) the complexity of understanding powerful fluid materials, which proves to be a difficult subject for students to master. Students encounter difficulties in applying the two fundamental principles of fluid dynamics, specifically the continuity equation and Bernoulli's principle, when engaging with these materials (Schäfle & Kautz, 2019; Sholihat et al., 2017); 2) When dealing with dynamic fluid material, students frequently make the mistake of thinking that the pressure is proportional to the fluid's velocity (Calderón et al., 2017; Sholihat et al., 2017; Suarez et al., 2017); In schools, the process of learning dynamic, fluid concepts remains informative but does not provide students with real-world experience (Fathiah et al., 2015). Hence, the e-worksheet is planned in light of LOIS so that with trial exercises the pointers have been changed in view of active action, minds-on action, and SPS can be accomplished in unique fluid material.

Figure 1 depicts the developed e-worksheet's structure. The e-worksheet, depicted in Figure 1, is intended to examine students' hands-on, minds-on, and SPS activities. The phases of request-based discovery that will be carried out in the created e-worksheet can later be completely done from the primary phase of disclosure learning, intuitive shows, request illustrations, request labs, speculative request, and genuine application. With each stage, there are five exercises specifically: perception, control, speculation, confirmation, and application; however, perhaps not to the most significant level, this is acclimated to the qualities of the science content. In inquiry learning, this learning cycle of five activities provides additional structure for each level of inquiry. By traveling through the various phases of the learning cycle and levels of request, a student better figures out science as an interaction and an item and gains a lot more logical comprehension. This learning cycle with five new exercises is the fundamental linguistic structure for each degree of LOIS.

Figure 1. Front View of Each Learning Activity

An online test with multiple-choice questions and essays was administered to assess the instructional materials' efficacy. Two sample classes took the test, with a pre- and post-test administered at the beginning and end, respectively. Table 3 provides a description of the ability test results obtained prior to and following the use of the LOIS-based e-worksheet.

Table 3. Hands-on, Minds-on, and SPS average n-gain data.

Class	Variables	Pretest	Posttest	Average n-gain
1	2	3	4	5
Control	Hands-on activity	33.33	66.67	0.49
	Minds-on activity	30.00	64.67	0.46
	SPS	47.22	68.80	0.40
Experiment	Hands-on activity	38.67	82.67	0.72
	Minds-on activity	28.67	80.67	0.73
	SPS	55.40	92.87	0.84

The data presented in Table 5 indicate that the control class's average n-gain value for hands-on, minds-on, and SPS is known to be 0.49; With discovery learning based-learning, the SPS is known to be 0.40 with low criteria, which corresponds to 0.46 with moderate criteria. Meanwhile, the average n-gain percentage for hands-on, minds-on, and SPS in the experimental class was 0.72. With high criteria of 0.73 and 0.84, it can be concluded that students' hands-on, minds-on activity, and SPS have increased as a result of learning with LOIS. This is supported by the data from the ability analysis that was trained with a score of 87% using highly trained criteria. The data was reviewed based on three variables that have indicators in the LOIS learning model: the hands-on activity variable has indicators for Reacts, Sketches, and Measure; the minds-on activity variable has indicators for concludes, identifies, summarizes, and compares; and the SPS variable has the indicator trained for formulating problems, making hypotheses, determine the consequences of the examination should be visible in Table 4.

Table 4. Training as a result of the Skills Analysis

No.	Variable	Trained indicators	Percentage	Total Score Percentage	Category
1	HoA	Reacts	83%	87%	Highly Trained
		Sketches	100%		
		Measures	78%		
2	MoA	Concludes	87%	82%	Highly Trained
		Identifies	76%		
		Summarizes	87%		
		Compares	78%		
3	KPS	Formulate Problems	99%	93%	Highly Trained
		Making a Hypothesis	100%		
		Defining Variables	100%		
		Hypothesis test	80%		
		Presenting Data	91%		
		Presenting Results	85%		
		Overall Average		87%	Highly Trained

In view of the table above, it tends to be seen that every marker that was prepared shows a typical rate score in the profoundly prepared classification. This is in accordance with Tan and Wong (2012) which show that active, personalities-on-action has a positive connection with learning results got by understudies, dominance of ideas (minds-on-action), yet by doing active exercises, understudies' SPS turns out to be better, with a few supporting hypotheses to be specific. The hypothesis of social constructivist realization, where all information on understudies is socially developed and frames part of the field of student-focused constructivism, social constructivist learning has been confided in the field of Schooling (Vygotsky, 1978), and hypothesis composition which, as per Al-Issa (2006) comprehension of a text is extremely reliant upon the diagram that the peruser has, one of the most significant being the pattern of the substance.

Furthermore, alluding to the hypothesis that has been advanced by Nieveen and Plomp (2007) that the consequences of instructive exploration configuration should contain the legitimacy and impact of viability as an answer to the examination issue. The impact of viability can be extended by looking at the impacts emerging from the examination that has been done, so the emphasis on viability can cover a more extensive setting. As a result, the study's efficacy was enhanced by examining the students' reactions to reading and studying the e-worksheet, which were prompted by questions posed by researchers via questionnaires. The outcomes acquired from the examination are represented as understudy reactions, which should be visible in Table 5.

Table 5. Responses from Students

Aspect	Total score per statement	Max Score	Percentage	Category
Highlights of intelligent instructive materials	252	280	90%	Very good
Application of knowledge and skills	394	440	90%	Very good
Perceptions of students about satisfaction	322	360	89%	Very good
Understudy Discernments About Individual Highlights	167	200	84%	Very good
Explanation of Purpose Intelligent showing materials helped by the Canva application	140	160	88%	Very good
Total	1275	1440		
Percentage Average			88%	Very good

The student response table indicated that students positively received the LOIS-based e-students' worksheet, with an average learning level percentage of 88%, positioning it within the "very good" category. The Canva-supported LOIS-based e-worksheet includes 3D animation (virtual labs) packaged in video format so that students can comprehend relevant dynamic fluid material more easily. As a result, the students' response to the e-worksheet was deemed to be very effective. This is consistent with the nature of students as members of generation Z, who cannot live without technology, according to Shatto and Erwin (2016).

In light of the depiction above, the consequences of the review show an expansion in involved action, minds-on movement, and SPS with high models. Students' responses to the Canva-assisted LOIS-based e-worksheet are in the very good category, and their hands-on, minds-on, and SPS after using the LOIS-based e-worksheet are highly trained. Therefore, it can be concluded that Canva-assisted LOIS-based e-worksheets enhance learning.

Conclusion

Canva's LOIS-based e-worksheet on dynamic fluid content in SMA Negeri 5 Bandar Lampung was found to be useful as a tool for learning, according to the research's findings and analysis of the findings. In particular, it is known that: (1) the expansion in involved movement, minds-on action, and SPS normal n-gain scores got in the trial class is high; (2) Involved action, minds-on action, and understudies' SPS subsequent to utilizing e-LOIS-based students' worksheets are profoundly prepared with a typical rate score acquired of 87%; and (3) understudies' reactions to the utilization of Canva-assisted LOIS-based e-worksheets are in the awesome classification.

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