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Integration of *Kekehan* Traditional Game to Measure Students' Creative Thinking Skills in Physics Learning

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Abstract. Physics learning is expected not only to focus on understanding theory, but students can apply physics in everyday life. One example of the application of physics that can be used in accordance with the era of society is the traditional game of kekehan. Therefore, this study aims to analyze the validation of the integrated test instrument of traditional *kekehan* games and the response of students after administering the test instrument. This research uses research and development design with ADDIE model in its development flow. The subject of the study was a test instrument developed integrated with traditional *kekehan* games, and trials on students. The data analysis technique used was quantitative descriptive from the validity and reliability values. The results obtained show that the instrument developed has very valid criteria. The results of suggestions from validators for improvement are to clarify the question instruction sentence briefly and concisely. The results of students' responses show that the difficulty of the physics concept of kekehan. This shows that there is still a lack of giving problems in physics learning as contextual problems. The general results can be concluded that the integrated creative thinking skills test instrument questions using the k*ekehan* game can be used to test students' thinking skills.
Keywords: *Kekehan*, creative thinking, test instrument

Introduction

Physics learning is expected to not only focus on understanding the theory by students, but also on the skills to apply physics concepts to solve physics problems in everyday life (Shah, 2019; Yildiz & Guler Yildiz, 2021). In this case, creative thinking skills (CTS) are needed, because with these skills students can find creative and innovative solutions to the problems faced (Khaerunisa et al., 2024). In the 21st century, creativity, CTS, communication, and collaboration known as the 4Cs are important components in education (Thornhill-Miller et al., 2023), including in physics learning which aims to develop CTS to face global challenges (Putri et al., 2021; Rudianto et al., 2022). Therefore, learning in the 21st century must be able to relate to the problems of the Society 5.0 era which reflects technological developments and social interactions (Al-Emran & Al-Sharafi, 2022).

However, in reality, in physics learning there are still test instruments that focus on measuring cognitive abilities and do not involve problems that require students' CTS (Burkholder et al., 2020). These test instruments often do not link physics concepts in real

situations that are relevant to technological developments, especially in the 5.0 era where every learning must foster CTS (Carayannis et al., 2022). This results in the potential development of students' CTS not being optimal and students have difficulty in developing creative solutions to problems (Morphew, 2021). In addition, the lack of connection between learning materials and the application of physics concepts makes physics learning considered to teach abstract concepts and not keep up with the times (Michael et al., 2024).

In order for physics learning to be relevant to the times, it is necessary to develop CTS test instruments that are able to measure and hone students' CTS (Musdi et al., 2024). CTS test instruments based on local wisdom can be used as a solution to measure and hone students' CTS (Susanto et al., 2023). The development of CTS test instruments based on local wisdom can provide an understanding of physics concepts that are more effective and relevant to everyday life so that students can easily apply physics concepts creatively (Lestari & Suyanto, 2024; Sari et al., 2020). Therefore, the development of CTS test instruments based on local wisdom is needed as a solution in realizing active learning while honing students' CTS (Parhan & Dwiputra, 2023).

In the context of physics learning, this research focuses on developing a local wisdom-based CTS test instrument and evaluating the validation and reliability of the test instrument. CTS test instruments based on local wisdom are developed in order to measure CTS by considering the existing local context, thus producing effective and meaningful assessment results (Abidinsyah et al., 2019; Pamenang, 2021). This research will also evaluate students' interest and response in using local wisdom-based CTS test instruments, especially in terms of solving physics problems related to the society 5.0 era.

The local wisdom used in this study is the traditional game of kekehan. According to Deta et al. (2024), *kekehan* has a physics concept that can improve the learning process and attract student involvement in learning because using games in learning has been proven to facilitate student understanding. In addition, according to Larasati (2011), the traditional game of *kekehan* contains essential values for children's physical and mental development. Thus, this research is expected to significantly improve the effectiveness of physics learning and encourage the growth of students' CTS to the demands of the times. Therefore, it is necessary to develop test instruments that are adapted to the context of local wisdom so that the research problems are as 1) how is the validity and reliability of the integrated game *kekehan* creative thinking test instrument? 2) how do students respond to the integrated game *kekehan* creative thinking test instrument?

Methods

The method in this research is the research and development method. The research method is a model that creates a particular product and tests the feasibility of the product (Sugiyono, 2020). The ADDIE development model was employed in this study. The ADDIE development paradigm consists of five stages: 1) analysis, 2) design, 3) development, 4) implementation, and 5) evaluation. The research flow includes five stages based on the ADDIE method depicted in Figure 1.

Figure 1. ADDIE research method

The first stage is to analyze the material or physics concepts used to develop test instruments. The second stage is designing the test instrument product design by making a grid to plan the idea of making items. The third stage is to develop the material or physics concepts that have been analyzed previously to improve the quality of the product by the indicators to be achieved. The development was carried out by integrating local wisdom into the items and adjusting to the indicators of creative thinking. The fourth stage is to implement the developed test instrument to students. The fifth stage is to evaluate the developed test instrument to determine the feasibility of the instrument and whether it is feasible to use in the learning process. In addition, the evaluation was also carried out based on students' responses after working on the test instrument. This research produces a product in the form of a CTA assessment instrument based on traditional *kekehan* games. This research uses a descriptive quantitative approach to analyze the quality and feasibility of CTS test instruments and describe students' responses to test instruments.

The research population was high school students who obtained the moment of inertia and angular momentum material. At the same time, the trial sample involved students in 2 classes. The number of students in each class is 30 students. Test instruments were used for data collection in this study. According to Septiana (2016), a test is a tool used in carrying out assessments, generally in the form of a series of tasks that students must do either individually or in groups whose results can describe the expertise of students. Additionally, a questionnaire was used to collect data. According to Purnomo & Palupi (2016), a questionnaire collects data through several questions or statements in writing to respondents to provide answers. Giving a questionnaire aims to find out the students' responses to the test instrument that has been developed. The test instrument developed was adjusted to the CTS indicators shown in Table 1.

Table 1. Creative thinking indicators

Indicators of creative thinking ability	Creative thinking behavior
Fluency	a) Be able to make some meaningful answers b) The flow of thoughts is smooth
Elaboration	a) Expanding an idea b) Ability to detail certain details c) Developing an idea
Flexibility	a) Able to make answers from different perspectives b) Able to convey ideas from different directions
Originality	The many variations in giving answers that are different from others

(Source: Guilford, 1967)

In this development research, two stages of validation were carried out in the form of expert validation and empirical validation. According to Situmorang & Purba, (2019) the validity test aims to determine whether the research instrument used is valid or invalid. The test instrument was validated by expert lecturers through a validation sheet. The CTS test instrument developed contains 4 items of description questions by containing four indicators of creative thinking. The expert validation sheet used to obtain the theoretical feasibility of the test instrument contains aspects of content, construction, and language validation. A measuring instrument has high validity if it is precise in measuring the object that should be measured.

The validity test was carried out by calculating the average percentage of each assessment indicator. In calculating the validity, the percentage results will be categorized based on the criteria according to Arifin (2016) presented in Table 2.

Table 2. Validity criteria

Value validity (%)	Validity criteria
0-20	Very less
21-40	Less
41-60	Enough
61-80	Valid
81-100	Very Valid

If the instrument has been declared valid, then the reliability test is carried out using SPSS software. Hasan (2014) states that the reliability test aims to determine the consistency of the research instrument used even though the measurement is repeated. The criteria for testing reliability using SPSS are.

Table 3. Criteria for reliability results using alfa cronbach

Reliability results	Criteria
$0.80 < r_{11} \leq 1.00$	Very High
$0.60 < r_{11} \leq 0.80$	High
$0.40 < r_{11} \leq 0.60$	Enough
$0.20 < r_{11} \leq 0.40$	Low
$0.00 < r_{11} \leq 0.20$	Very Low

(Source: Arikunto, 2016)

Results and Discussion

Analysis Stage

Before developing the researcher made observations and case studies. According to Al Emran & Al Sharafi (2022), learning in the era of society must use a social and cultural approach, so that physics learning must provide applications in the social and cultural fields. The results of observations show that the culture owned by Indonesia is almost extinct, because nowadays most of the learning process does not introduce culture to students. The results of interviews with teachers show that to avoid the extinction of culture owned by Indonesia is to introduce culture in learning. This is supported by the statement of Hikmawati et al (2024) & Lucia & Abril (2023) that teachers have an important role in learning physics and providing applications, one of which relates to local wisdom. One of the local wisdom that can be used as a problem is the traditional game of kekehan. According to Deta et al (2024), the physics concept can improve the learning process and attract students' involvement in learning because the utilization of games in learning has been proven to facilitate students' understanding. Therefore, researchers at this stage require observations related to the implementation of local wisdom that can be integrated in physics learning. To strengthen this research, there is relevant research that is suggested to carry out integrated learning of local wisdom, one of which is on the traditional game of *kekehan*, as shown in Table 4.

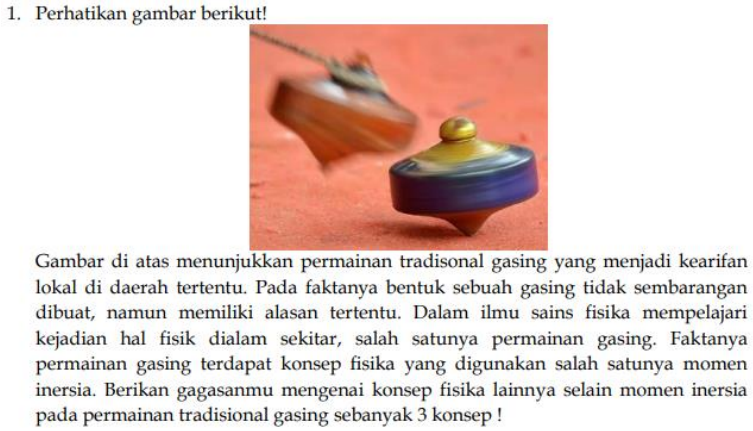
Table 4. Relevant literature research

Source Literature	Result Literature
Suprapto et al., (2021)	The Indonesian curriculum is related to learning local wisdom, so it is necessary to develop local wisdom learning for contextual problems to improve thinking skills.
Eliezanatalie & Deta (2023)	Physics concepts connecting modern science with ethnoscience in traditional games can be used as physics learning materials.

Maulida & Sunarti (2022)	Test questions based on local wisdom should continue to be developed by including local wisdom in other regions. Physics teachers are advised to introduce and train students through local wisdom.
Deta et al., (2024)	The study results show that persistence has a physics concept, including the moment of inertia and angular momentum, so that it can be developed into a contextual problem in learning.
Nisa et al., (2024)	EQT (ethnoscience-quizizz test) combines indicators for problem-solving, making it suitable for 21st-century learning with ethnoscience.

Design Stage

In this section, the researchers designed the integrated question instrument of *kekehan* local wisdom for contextual physics problems. The results of the question design developed as shown in Figure 2.


1. Perhatikan gambar berikut!

Gambar di atas menunjukkan permainan tradisonal gasing yang menjadi kearifan lokal di daerah tertentu. Pada faktanya bentuk sebuah gasing tidak sembarangan dibuat, namun memiliki alasan tertentu. Dalam ilmu sains fisika mempelajari kejadian hal fisik dialam sekitar, salah satunya permainan gasing. Faktanya permainan gasing terdapat konsep fisika yang digunakan salah satunya momen inersia. Berikan gagasanmu mengenai konsep fisika lainnya selain momen inersia pada permainan tradisional gasing sebanyak 3 konsep !

Figure 2. Question indicator flexibility

Figure 2 shows question number 1 with flexibility creative thinking indicators. In this indicator learners must provide answers from different points of view. Problem number 1 instructs students to provide answers to ideas about physics concepts that exist in traditional *kekehan* games other than the concept of moment of inertia.

2. Diberikan suatu bahan dasar untuk pembuatan gasing tradisional sebagai berikut :
   1. Kayu dengan massa 85 gram
   2. Kayu dengan massa 41 gram
   3. Bambu dengan massa 85 gram
   4. Bambu dengan massa 41 gram
   5. Logam dengan massa 41 gram
   6. Logam dengan massa 85 gram
   7. Plastik dengan massa 5 gram
   8. Plastik dengan massa 10 gram

Pada pertandingan gasing tradisional, pemain dikatakan menang apabila gasing dapat berputar lebih lama daripada gasing yang lain. Untuk memenangkan suatu pertandingan gasing tradisional, maka bahan dasar apa yang anda gunakan? Dan beri penjelasan!

Figure 3. Question indicator elaboration

Figure 3 shows question number 2 with the elaboration creative thinking indicator. In this indicator, learners must develop ideas or produce in detail an answer. Problem number 2 instructs learners to provide an idea to choose the material to be used for the race with the concept of moment of inertia and provide reasons why the material is used.

3. Berdasarkan definisi kekehan merupakan permainan tradisional yang berarti akeh-akehan mumet. Permainan ini memiliki kriteria pemenang yang paling lama berputar. Faktanya untuk menjadi pemenang dalam permainan tersebut terdapat konsep fisika yang harus dipahami, yaitu konsep fisika momen inersia dan momentum sudut. Hal ini dapat dibuktikan seperti gambar dibawah ini

Berikan rancangan anda, bagaimana cara membuat kekehan anda dari sudut pandang bahan dan bentuk dalam konsep fisika agar gasing kekehan dapat berputar lama!

Figure 4. Question indicator originallity

Figure 4 shows question number 3 with the originallity creative thinking indicator. In this indicator, learners must provide answers that vary according to their thoughts. Problem number 3 instructs learners to provide ideas related to the design of the *kekehan* that will be made so that it can last a long time in rotation.

4. Dalam acara perlombaan di kampung RT 06 mengadakan sebuah perlombaan gasing tradisonal seperti gambar berikut

Peraturan lomba tersebut, pemenangnya adalah gasing yang paling lama berputar dan tidak keluar dari arena permainan. Dalam konsep tersebut yang digunakan merupakan momen inersia. Berikan 3 solusimu dengan konsep momen inersia agar menjadi juara dalam perlombaan gasing !

Figure 5. Question indicator fluency

Figure 5 shows question number 4 with the fluency creative thinking indicator. In this indicator, learners must find ideas to solve problems. Problem number 4 provides instructions for learners to find an idea for the problem of a *kekehan* that can spin for a long time as many as three ideas.

Development Stage

At this stage the researcher conducted a validity test on the physics learning assessment expert. The aspects of validity assessed are content, construct, and language. The validity results obtained by the validity test are as shown in Table 5.

Tabel 5. Validation result

Aspect	Validity Test				Reliability
	Validator 1 (%)	Validator 2 (%)	Average	Criteria	
Content	95	100	98	Very Valid	0.909
Construct	100	100	100	Very Valid	
Language	88	88	88	Very Valid	

The results obtained show that all aspects get very valid criteria. This shows that the developed test question instrument can be used for limited trials on students. This limited trial is used to evaluate the test question instrument developed so that it can be further developed and can be generalized, so that it can be used to measure students' thinking skills through the context of ethnophysics learning (Hidayaatullah et al., 2021).

Evaluation Stage

At this stage the researcher evaluates the question instrument developed. This evaluation was carried out on the responses of students and suggestions from validators. Table 6 shows the results of the evaluation of the question instrument from the validator.

Table 6. Validator suggestions

	Comment
Validator	Provide instructions for working on the problem
	Clarifying the statement in the answer
	The sentence in the question is more clarified

Table 6 shows the validator's suggestions related to improving the question sentence clearly, briefly, and concisely. The purpose of clarifying sentences briefly and concisely so that students can immediately understand the question points that must be answered. According to Thompson et al (2021) writing short and concise question sentences aims to avoid ambiguous sentences. Therefore, the improvement of questions that must be done in the future is to use clear sentences in a short and concise manner.

The next evaluation is based on the students' response questionnaire. This questionnaire discusses the causes of students' difficulty answering the questions given. The evaluation results are as shown in Figure 6.

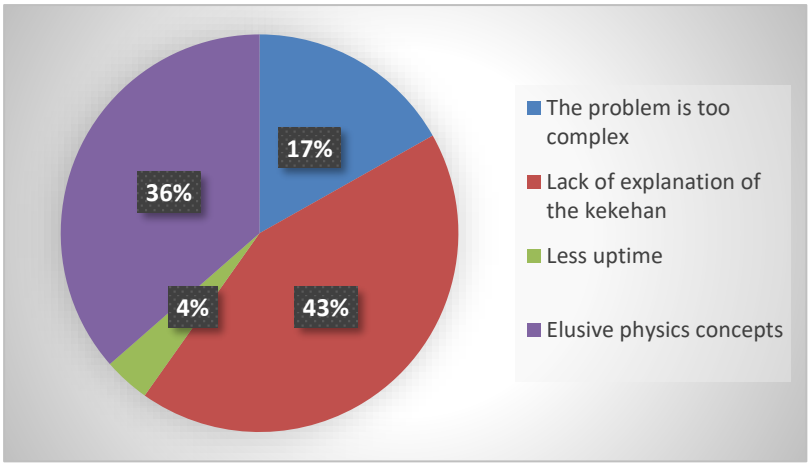


Figure 6. Diagram of learner response

The results obtained showed that 43% stated that students had difficulty in working on problems due to a lack of knowledge about *kekehan* in physics concepts. A total of 36% stated that physics concepts are difficult to understand for students. The results obtained show that learners have difficulty because the physics concept on *kekehan* is difficult to understand. This result is also reinforced by the response of students stating that 60% of students know *kekehan* by definition, but 58% cannot understand the physics concept on kekehan.

Based on the results of students' responses, it shows that there are still few applications of physics concepts. This is supported by several studies which state that it is important to provide knowledge about the application of physics concepts (Jonassen & Car, 2020; Iten et al., 2020). According to Lubis et al (2022) that local wisdom can be one of the applications of physics learning as a contextual problem. Therefore, in the future, physics learning is expected to provide an application in everyday life, one example is the local wisdom of traditional *kekehan* games. In addition, it is hoped that future research can develop ethnophysics learning media that can help students understand the concept of ethnophysics in the game of *kekehan*. (Damarsha et al., 2025; Mirsa et al., 2023; Sunarti et al., 2024).

Conclusion

Based on the findings of the study, it can be said that the test instrument has extremely valid requirements for use. The comments from the students indicated that they had trouble grasping the physics idea on *kekehan*. This is due to the fact that pupils have never been exposed to the idea of physics in a local context. Therefore, in order to enhance students' comprehension of physics principles, contextual physics problems must be provided. It is anticipated that future studies on ethnophysics education will advance. Further research can develop media that can help students understand the concept of ethnophysics in the game of *kekehan*.

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