



Kiwari: Inquiry Smart Module (Investigation Fiction Case-Based) as an Approach to Integrative Science for Student's Analytical Thinking Competencies in Senior High School

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Abstract

The ability to think analytically and critically is one of the keys to carrying out education, which can make students understand comprehensive information and associate between components. However, to train the students' analytical and critical thinking skills, their interest and excitement towards the learning process must be approached. This research was conducted to attract and increase students' interest in learning Biology and Chemistry (Integrative Science), providing an alternative or inspiration for inquiry science learning media to train students' analytical thinking skills and creating a Learner-Centred class. The method used in this study is Research and Development (4D Model); the module design includes the Define, Design, and Development stages. Furthermore, the Two Group Randomised Experiment Method was used to test and measure the feasibility of the Kiwari Module. In this research, the parameters used to test the effectiveness of the module include the parameters to measure in terms of students' interest or excitement in learning, the use in terms of honing students' analytical thinking skills, and the use in studying Biology and Chemistry material, as well as student participation or contribution actively on learning. This study found that the module was said to be effective in increasing students' interest in learning Biology and Chemistry by up to 92%. The analytical uses of the module were scored 4.5 out of 5 by the material experts and suitable for use as a science inquiry learning media option up to 71%. The module was 70.6%, involving students participating actively in the class (Learner-Centred Class).

Keywords: Analytical Thinking, Biology, Chemistry, Integrative Science, Inquiry Module, Learner-Centred Classroom, Science Learning Media, Student Interest

Introduction

Technological development is one thing that cannot be avoided and will always happen on earth. With the development of technology, it is necessary to develop and improve human quality as well. A politician, Nelson Mandela, once said that education is the most powerful weapon you can use to change the world. Apart from being a teaching process, education is also said to be a process of transferring knowledge, transforming values, and forming personality with all the aspects it covers, this is necessary to get balance and perfection in the

development of individuals and society (Nurkholis, 2013).

At this time, Indonesia and the world are in the Industrial Revolution 4.0 and the Era of Society 5.0. In facing the development of this era, it is essential to make efforts to increase and optimise human resources in terms of education so that they can contribute on a global scale and as provision in the future. The ability to think analytically and critically is one of the keys to undergoing education in this era because this will make students understand comprehensive

information and associate between components (Brookhart, 2010; Yilmaz & Saribay, 2017; Dinni, 2018). Education in Indonesia itself has carried out the development of modern learning that is oriented towards HOTS (High-Order Thinking Skills) so that students become accustomed to thinking critically; hence, they can develop their creativity (Wena, 2020) as a form of quality improvement efforts to face Industry 4.0. High-Order Thinking Skills is the ability to connect, manipulate, and change the knowledge and experience the students already have critically and creatively in making decisions to solve problems in new situations (Dinni, 2018).

The analytical thinking skills of Indonesian students is known to be low. This is viewed by Indonesia's participation in TIMSS (Trends in International Mathematics and Science Study) about five times, including in 1999, 2003, 2007, 2011, and 2015. This participation shows that Indonesian students' ranking results are always included in low-ranking countries. Furthermore, in one of the research studies conducted by Prawita et al. (2019) about measuring Kotabumi students' analytical thinking skills on respiratory system material, it was found that 49% of the total students still have analytical thinking skills in a very poor category. 42% have analytical thinking skills in a poor category, and 9% in a fair category. This research does not obtain any students with a good or excellent category of analytical thinking skills.

Several factors support all the cases mentioned above, such as the learning strategy and monotonous learning material (repeating questions, multiple-choices, and long essays). The usage of routine questions causes low student curiosity (Sulistiani et al., 2018). Therefore, it will create a monotonous class and not catch students' interest towards the material, which will end up not supporting them to have the capability to analyse the questions thoroughly. Moreover, not engaging students' participation by having a one-way communication type of

teaching could also be a factor. Developing logic, critical thinking, and analytical thinking skills will be challenging if learning is conducted with a strategy that includes students memorising materials (Kao, 2014). On the other hand, allowing students to observe, research, and discuss based on problems presented by the teacher can train students' analytical thinking abilities (Widyaningsih et al., 2018).

Based on research studies have been done showing how previous learning strategies and materials have affected the opportunity for students to train their analytical thinking skills. This research study innovates an inquiry type of module to support students in preparing their analytical thinking ability. The inquiry-based models begin with a problem that can improve analytical thinking skills since it encourages students to discuss and investigate problems, sum up the results, and communicate them well (Ramadani et al., 2021). The whole Kiwari Module uses a unique concept which is compiled with the concept of case studies as well as illustrations with approaches to Biology and Chemistry. This emphasises students to investigate the cases and narratives (storylines). Learning with inquiry models prioritises students to not only provide the right solution but also can analyse the case (Ahaddin et al., 2020).

This module is an integrated science module because, in practice, literacy learning must be varied and all subjects should be integrated to see the diversity of students' potential integration (Budiono et al., 2021). In addition, according to Fogarty (Budiono et al., 2021), integrative learning is a learning process that integrates the curriculum of various topics across disciplines. The purpose of integrative literacy-based learning is to make students able to understand and analyse a text. Therefore, with the plan to create this module, it is hoped that later, it will be able to attract and arouse students' interest to be able to investigate cases in the module, as well as become a form or concept of a new variation in the application of High-Order Thinking Skills.

Methodology

3.1 Data Sources, Tools, and Materials

The research was conducted at MAN 4 Jakarta from July to September 2022. This analysis is a Research and Development study in which data acquisition is obtained by adapting one of the research and development methods, the 4D Model developed by Thiagarajan, Semmel, and Semmel 1974. The 4D itself consisted of Define, Design, Development, and Disseminate. However, the research carried out in this module will be limited to the Development stage.

Furthermore, the Two Group Randomised Experiment Method was used to test and measure the feasibility of the Kiwari Module in the class. There would be two different classes from MAN 4 Jakarta (XI IPA 1 and XI IPA 3), which would be subject to compare the study's final results. XI IPA 1 would be the Treatment Group that received the treatment being researched; in this case, XI IPA 1 was the one who tested the Kiwari Module in the class. Meanwhile, XI IPA 3 would be the Control Group that did not receive the treatment being researched; they were learning in the general Biology and Chemistry class without the Kiwari Module.

The parameters used to test the feasibility and effectiveness of the module include the parameters to measure in terms of students' interest or excitement in learning, the used of the module in terms of honing students' analytical thinking skills, and the used of the module in studying Biology and Chemistry material, as well as student participation or contribution actively on learning.

3.2 Data Collection Method

The first stage is the Define stage, which is carried out to identify and find out the facts behind the creation of this module through literature study activities. At this stage, it aims to determine and define the requirements needed in learning by analysing the objectives and limitations of the material

developed by the device (Kristanti & Julia, 2017). The next stage is Design that includes the creation of instruments for the validator and the module framework according to the Module Design plan. This design is retrieved to determine that the modules are made according to learning needs. Meanwhile, the third stage is Development in order to maximise the modules' concept and produce revised module based on input from validators or experts in their fields and to test the feasibility of the module according to learning needs.

After the modules were validated, the next stage was the module trial for XI IPA 1 students. The method used in the module trial phase to test the modules' effectiveness is the Two Group Randomised Experiment method. In the end, XI IPA 1 and XI IPA 3 students will complete the same questionnaire to compare the difference between the class with and without the Kiwari Module in the Treatment and Control group.

3.2 Data Analysis

The data analysis method used in this study is descriptive qualitative data analysis; the data will be analysed using two variables, namely, the product's characteristics and the module's quality. The instrument used to analyse the data comes from the results of a questionnaire that the respondents will fill out after working on the module to measure its impact and effectiveness. Data analysis includes aspects in the module such as whether the language is easy to understand, presentation systematics, implementation aspects, whether the module attracts students' interest, and so on as parameters which will later be accumulated to get a final result in the form of a percentage then the results are analysed according to the scale module eligibility.

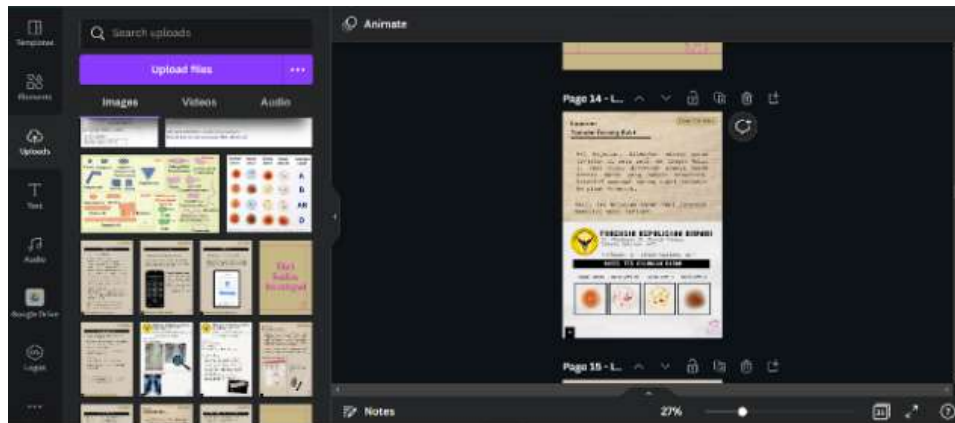
Results and Discussion

This study aims to create an inquiry module that can be used as a variation of a new concept to attract students' interest and improve analytical thinking competence as

well as create a student-centred learning class (Learner-Centred Class). Starting with the 4D Modelling stage in module design, the design of this inquiry module starts from the module concept, which is inspired by investigative and detective concepts. At the module design stage, starting from making narrative cases and determining material with literature and literature studies to find out

what materials will be covered and linked in the module.

Furthermore, the preparation of module and the manufacture of designs or illustrations of module is carried out using the Canva software (Picture 1). Finally, the module validation stage was carried out by material experts.



Picture 1. Module Illustration and Design

The instrument validation stages in this module are carried out by means of experts' judgment in producing instruments, in this case, the Biology and Chemistry Teachers of MAN 4 Jakarta.

The questionnaire consisted of 8 questions with a rating range of 1-5. Aspects of module assessment include Student Interest, Learner-Centred modules, and Analytical Uses of Modules. The comments, suggestions and input given by the material experts are contained in Table 2.

Table 1 presents the data from the expert assessment results of the questionnaire used for the validation.

Table 1. Results from Material Experts

Scope Scoring	Experts Score		Total Average	Notes
	1	2		
Student Interest	5	4.5	4.75	Very value
Learner-Centred Module	4.6	4.6	4.6	Very value
Analytical Uses of Module	5	4	4.5	Value
Total Score Average			4.6	Very Value

Table 2. Suggestions and Advice from the Material Experts

<i>No.</i>	<i>Suggestions and Advice</i>	<i>Follow-up</i>
1.	The instructions and steps of the module are clear	-
2.	In the section on respiratory system disorders, additional information is needed about the bacteria that cause the disease	Adding information and modifications or revisions regarding the form of problems with respiratory system disorders
3.	Reflections are strengthened during the class	Making presentation slides for students' reflection after working on the module.
4.	Revision regarding the beginning of the paragraph to be indented	Revised

Table 2 shows the list of suggestions and advice, including the follow-up of the suggestions from the Material Experts (Validators). There are at least four main suggestions and advice from both experts, with all of them already being solved or revised as the experts suggest.

The subject of this research is class XI (11) IPA MAN 4 Jakarta. There are two classes, where one class (XI IPA 1) is the group that gets the trial (Treatment Group), and the other class (XI IPA 3) is the group that does not get the treatment (Control Group). The trial of the Kiwari Module was conducted on Wednesday, 5th October 2022 (Picture 2). The research was conducted in the Treatment Group, class XI IPA 1 MAN 4 Jakarta. Before the module was tried out, the students read the instructions and were divided into groups. Furthermore, the trial began with the duration of working on the module for 1 hour and 30 minutes. After working on the module, each group prepares two people to present the results of their analysis of cases in the module in class (Picture 3). Next, a discussion of the modules is carried out, including the cases contained in the module (Picture 4). After the end of the

trial, students were asked to fill out a questionnaire related to their experiences during the whole class, their interests, the content, form, or design of the Kiwari Module.



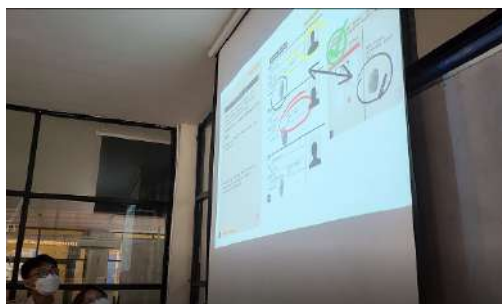
Picture 2A. Kiwari Module Trial



Picture 2B. Kiwari Module Trial



Picture 3. Presentation Post-Module Work



Picture 4. Module Discussion

The data used in this study were primary data based on a specialisation questionnaire in Biology and Chemistry which was given to students in both Treatment Group class XI IPA 1 and Control Group XI IPA 3 MAN 4 Jakarta. The trial of the Kiwari Module has been carried out and the group that received the treatment, namely class XI IPA 1, received and filled out the specialisation questionnaire as well as the Module Effectiveness Validation and Feasibility Validation questionnaires. Later, this data will be used as a benchmark for comparing the interests of students who received the module treatment (Kiwari Module) with students who did not receive the treatment.

Interest Measurement of Control Group

Class XI IPA 3, which also served as the control group in this study, filled out 16 questions in the questionnaire or interest questionnaire in Biology and Chemistry learning, where the questions were related to their experiences and interests during the Biology and Chemistry learning process in general classes (without Kiwari Module).

Table 3. Percentage of Control Group's Interest

<i>Interest Ranges</i>	<i>Interest Percentages</i>
Interested	52%
Average	26%
Not Interested	22%

Based on Table 3, it is known that 52% of students in class XI IPA 3 have an interest in learning Biology and Chemistry with general learning methods. While 26% are known to have an ordinary interest in learning Biology and Chemistry, 22% of students are not interested in learning Biology and Chemistry.

Interest Measurement of Treatment Group

Table 4. Percentage of Treatment Group's Interest

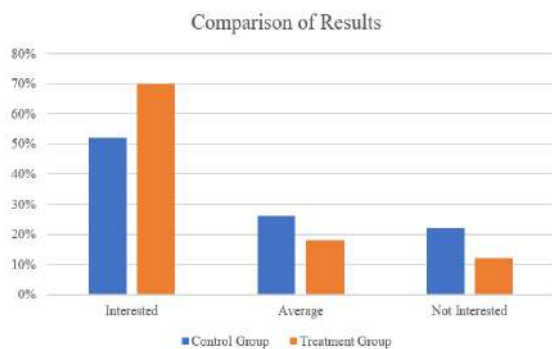
<i>Interest Ranges</i>	<i>Interest Percentages</i>
Interested	70%
Average	18%
Not Interested	12%

Based on the data shown in Table 4, as many as 70% of students in class XI IPA 1 felt interested in learning Biology and Chemistry with the Kiwari Module used during the class. Meanwhile, 18% are known to feel the same way (ordinary) during module trials and learning in general. Meanwhile, 12% or as many as two students felt not interested in learning Biology and Chemistry. Class XI IPA 1, which also served as the treatment group, had 17 students and had been divided into groups of 4-5 people when the module trial was carried out.

Comparison of Results

The results of the two studies were then measured and compared between the results from the Treatment Group (XI IPA 1) and the

Control Group (XI IPA 3). The purpose of the comparison is to record progress in research.



Picture 5. Comparison between Control and Treatment Group

The diagram above shows (Picture 5), a difference in the percentage of students' interest reaching approximately 20% in

Biology and Chemistry learning using the Kiwari Module. Besides, there is a difference of up to 10% in students' disinterest in learning Biology and Chemistry without the Kiwari Module.

The last stage of this research is the validation of the Kiwari Module. After completing the Kiwari Module trial, class XI IPA 1 received and filled out the Module Effectiveness Validation and Feasibility Validation questionnaires. The questionnaire is a benchmark for respondents to determine whether the Kiwari Module is effective and feasible in attracting students' interest in learning Biology and Chemistry. Their responses to the Kiwari Module and the Biology and Chemistry Learning Process using Kiwari are listed in Table 5.

Table 5. Percentage of Responses on Respondents Questionnaire

Benefits Aspects	Average Rating Scale			Notes
	5	4	3	
Use of Module to attract students' interest	80.4%	11.76%	7.84%	Very Agree
Use of Module to train Analytical Thinking Competency	70,6%	22.05%	7.35%	Very Agree
Use of Module to study Biology and Chemistry material	29.4%	52.9%	17.6%	Agree
Use of Module to involve students actively contributing to class (Learner-Centred Class)	70.6%	26.45%	2.95%	Very Agree

Notes:

5: Very Agree

4: Agree

3: Uncertain

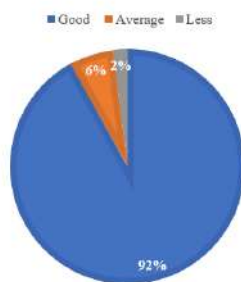
According to the data shown in Table 5, 80.4% of students very agreed that using the Kiwari Module could interest them in learning Biology and Chemistry because they were equipped with a unique concept and illustrations that match the material to attract students' interest in learning. This is in line

with research by Septiani et al. (2013); Afridah et al. (2022), who stated that teaching which is attractively designed and equipped with pictures attracts students' interest.

The use of module can also train students' analytical thinking competencies which 70.6% of students agree that learning

activities with Kiwari can hone their analytical skills in linking Biology and Chemistry learning in everyday life. The module is equipped with consecutive and further questions that encourage students to solve and investigate the case inside the module by connecting links between evidence that have a relation to the Biology and Chemistry materials to find appropriate conclusions and solutions. This is supported through research done by Kusdiastuti et al.

EFFECTIVENESS VALIDATION



Picture 6A. Effectiveness Percentage

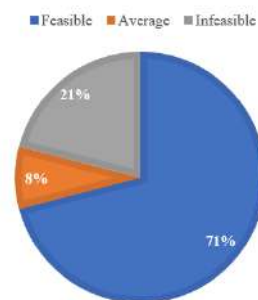
According to the data obtained from the XI IPA 1 questionnaire (Pictures 6A and 6B), the Kiwari Module received positive results. Based on Pictures 6A and 6B, the Kiwari module gets a percentage of the effectiveness of using the module by 92%, and the percentage of the feasibility of the module is obtained by 71%. Based on assessment data for each aspect, the Kiwari Module received a good response in field trials because the effectiveness of this module reached a percentage above 90% of class XI IPA 1 students.

The results of the study show that the module is categorised as effective up to 92% for the Biology and Chemistry class because it caught students' interest and encouraged students' active participation to investigate, analyse, and solve the case inside the module. This is in line with Sartika et al. (2018), who stated that inquiry-based learning is one of the models that prioritise student activity in the learning process, such as building independent learning and analysing complex information. Moreover, it is also supported by the research conducted in 2019 by Qadariah et al. They conducted an inquiry-

(2016) that inquiry-based learning involves students actively seeking, finding, and investigating knowledge

Furthermore, 52.9% of students agreed they could study Biology and Chemistry while working on this module. In addition, 70.6% of students felt that they could actively contribute to discussions, express opinions, and convey the results of their analysis to fellow group members.

FEASIBILITY VALIDATION



Picture 6B. Feasibility Percentage

based module research on the Material of the Reproductive System. In the study, it is known that the value of the effectiveness or usefulness of the inquiry-based module has a percentage above 90%.

Conclusion

The Kiwari Inquiry Module received positive responses from both the validator and students who received this module treatment. The Kiwari Module can be used as an alternative learning medium for Biology and Chemistry, which is able to attract students' interest in honing their analytical thinking skills by implementing a learning process that involves active involvement and contribution of students in discussing and exchanging ideas.

Based on the analysis and discussion of the data, the conclusion that can be obtained from this study is that there is a difference in the percentage of students' interests reaching approximately 20% in the control group and treatment group. This fulfils the objective of the research, to create an inquiry module that can be used as a variation of a new concept to attract students' interests in improving

analytical thinking competencies. In addition, according to the data listed, the Kiwari Module is able to help hone students' analytical thinking skills, reaching 70.6% improvement.

The Kiwari module can also be an alternative to inquiry learning that maximises student contribution and involvement during learning. It is in line with the aim of making this module, which is to maximise the contribution and activeness of students in the class (Learner-Centred Class) as an effort to improve analytical thinking competency.

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