



Digital interactive module based on team games tournament to develop collaboration and student's critical thinking skills on respiratory system material

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Article Information	Abstract
Keyword: Digital interactive module; Collaboration; Critical thinking; Respiratory system Kata Kunci: Modul interaktif digital; Kolaborasi; Berpikir kritis; Sistem respirasi History: Received : 07/04/2024 Revised : 09/05/2024 Accepted : 21/05/2024 Published : 29/05/2024	Collaboration and critical thinking skills are part of the 21st-century skills that must be mastered and developed. Therefore, innovative teaching materials are needed to help develop students' critical thinking and collaboration skills. This development research aims to produce Team Games Tournament (TGT) based digital interactive modules that are valid, practical, and effective for students. The instruments used are needs analysis in the form of teacher interview guidelines and questionnaires for students, teaching material and material expert validation sheets, and practicality sheets. Then, the effectiveness sheet is in the form of a pretest post-test sheet. Based on the results of the data analysis, the teaching material validation obtained a score of 98.55%, the material validation results obtained a score of 96.73%, the teacher response questionnaire results obtained a score of 97.92%, and the student response questionnaire results obtained a score of 93.15%. The effectiveness assessment resulted in an average N-Gain score of 0.80 with a high category, and the results of student collaboration skills scored 91 with a very effective category. Therefore, the TGT-based digital interactive module is considered a feasible, practical, and effective learning tool, facilitating the development of students' collaboration and critical thinking skills. However, further development research can expand the material on biology learning that has not been covered in the development of this interactive digital module. <i>Abstrak. Kemampuan kolaborasi dan berpikir kritis merupakan bagian dari keterampilan abad ke-21 yang perlu dikuasai dan dikembangkan. Oleh karena itu, diperlukan bahan ajar yang inovatif yang dapat membantu mengembangkan kemampuan berpikir kritis dan kolaborasi siswa. Penelitian pengembangan ini bertujuan untuk menghasilkan modul interaktif digital berbasis Team Games Tournament (TGT) yang layak, praktis dan efektif bagi siswa. Instrumen yang digunakan adalah analisis kebutuhan berupa pedoman wawancara guru dan angket untuk siswa, lembar validasi ahli bahan ajar dan materi, serta lembar kepraktisan. Kemudian lembar keefektifan berupa lembar pretest post test. Berdasarkan hasil analisis data, validasi bahan ajar memperoleh skor 98,55%, hasil validasi materi memperoleh skor 96,73%, hasil angket respon guru memperoleh skor 97,92%, dan hasil angket respon siswa memperoleh skor 93,15%. Penilaian keefektifan menghasilkan rata-rata skor N-Gain sebesar 0,80 dengan kategori tinggi, dan hasil kemampuan kolaborasi siswa memperoleh skor 91 dengan kategori sangat efektif. Oleh karena itu, dapat disimpulkan bahwa modul interaktif digital berbasis TGT dinilai sebagai perangkat pembelajaran yang layak, praktis dan efektif, memfasilitasi pengembangan keterampilan kolaborasi dan berpikir kritis siswa. Namun demikian untuk penelitian pengembangan selanjutnya dapat memperluas materi pada pembelajaran biologi yang belum tercakup dalam pengembangan modul digital interaktif ini.</i>

A. Introduction

In the modern era of globalization, advances in information technology have had a significant impact on education. Technological developments have encouraged educational planners to consider the suitability of the education system for entering the world of work with the skills needed to take advantage of future opportunities (Bayley, 2022). According to Amin et al. (2022), the education expected today is to produce students with 21st-century skills, namely science and technology, one part of education that becomes a guideline that must be prepared to produce quality humans. The Partnership for 21st Century Skills (P21) formulates several definitive skills, namely creative, critical thinking, independence, teamwork, creativity, information, communication, and learning independence (Ayuardini, 2022). According to Robbia & Fuadi (2020), one of the 21st-century skills that need to be mastered is using media by technological developments, collaborating, and thinking critically.

Facione (2015) argues that the definition of critical thinking ability is a cognitive ability used in interpreting, analyzing, evaluating, concluding, explaining, and self-regulating (Rani et al., 2018). Another opinion from Ennis (2011) says that critical thinking is a way of thinking that is reasonable and reflective, and decision-making is related to beliefs or something done. Hidayat et al. (2019) also argue that what is meant by critical thinking skills is the ability to use deep reasoning to explore relevant and accountable information. Critical thinking skills lead to the ability to carefully and thoroughly analyze concepts, find, analyze, and construct thinking processes using logic and evidence to lead to more valid conclusions (Nesri & Kristanto, 2020). Hendi et al. (2020) state that critical thinking is making decisions and analyzing, identifying, evaluating, and solving problems logically and creatively.

Developing critical thinking skills is often associated with the ability to collaborate (Anwar et al., 2015). The ability to collaborate with critical thinking skills brings several interconnected benefits. Through collaboration, individuals can combine various perspectives and expertise and enrich critical thinking with new ideas and diverse points of view (Yudhanta et al., 2021). This statement also follows Fahmi et al. (2020), who states that collaborative skills can create learning situations involving collaboration. Hence, learning activities involve interrelated processes such as asking, explaining, justifying opinions, arguing, and elaborating. Cooperative learning requires students to be able to learn together (teamwork) to become individuals who desire to share knowledge and create mutual understanding in groups (Handayani et al., 2018).

As in the holy book of the Qur'an, it explains the ability to work together or collaborate, especially in

Islamic teachings as stated in the Qur'an Surah Al-Hujurat verse 13 which reads:

يَا أَيُّهَا النَّاسُ إِنَّا خَلَقْنَاكُمْ مِنْ ذَكَرٍ وَأُنْثَىٰ وَجَعَلْنَاكُمْ شُعُوبًا
وَقَبَائِلَ لِتَعَارَفُوا ۚ إِنَّ أَكْرَمَكُمْ عِنْدَ اللَّهِ أَتْقَىٰكُمْ ۚ إِنَّ اللَّهَ عَلِيمٌ
خَبِيرٌ ١٣

Meaning: "O people, indeed We have created you from a male and a female. Then, We made you into nations and tribes so that you may know one another. Indeed, the noblest among you in the sight of Allah is the most pious. Verily, Allah is All-Knowing and All-Absorbing" (Surah Al-Hujurat verse 13).

This verse shows that although everyone has their nation and tribe, they are all descendants of Adam and Eve. Since all humans are equal and brothers in one group, no one should feel superior to others because of their tribe. A team that works together, respects, and cares for each other. As social beings, Muslims are always taught the importance of cooperation, which emphasizes establishing Islamic ideals and strengthening a sense of brotherhood in society, which can be developed through mutual tolerance (Fauzi, 2022).

Developing critical thinking and collaboration in learning activities is essential (Uki & Liunokas, 2021). However, it is unfortunate that, in reality, in the field, it was found that in Indonesia, the average level of critical thinking of students is still relatively low (Mardhiyah et al., 2021). This is in line with research conducted by Agustina et al. (2021), which found that one of the junior high schools in Kerawang had an average critical thinking ability classified as low, with a score of 61%. Amijaya et al. (2018) argue that one of the problems often faced in Indonesia, which causes students' critical thinking skills, is the learning process in the classroom, which still needs to be strengthened. The absence of encouragement from teachers makes students' critical thinking skills more developed, where the learning process is only directed to memorize material without being required to understand what they memorize. Hanafi & Nashicah (2022) also reported that the average score of students' critical thinking skills in one of the Sula Islands high schools was still low, with an average critical thinking skills score of 30.91%. This is because some biology learning processes do not involve students, so students are less active and creative. In addition, many teachers still use conventional learning models that inhibit critical thinking skills, and understanding of the concepts contained in biological material could be much higher.

Based on the existing problems, the low level of critical thinking and student cooperation is caused by teachers who still use teacher-centered learning methods, not students, and the need for more support

for learning tools to facilitate understanding of the material presented. This is based on the observations and interviews researchers obtained from biology teachers at Madrasah Aliyah Laboratorium UINSU, where the learning process activities still use the lecture method and learning media assisted by printed books. Thus, students' interview responses said there were deficiencies in the learning process. The way the teacher delivers, or the methods and teaching materials used are among the factors. According to students, the use of printed books needs more visual appeal. In addition, the breadth of material in textbooks can also pose challenges for students in understanding it, sometimes also causing feelings of boredom or disinterest because the breadth of material needs more exciting elements to attract students' attention. This impacts students' critical thinking and collaboration skills.

Therefore, innovative learning resources or teaching materials are needed, such as teaching materials that are not only a source of knowledge that contains material but can also stimulate the improvement of students' critical thinking and collaborative skills through various features. These teaching materials play a role in improving students' critical thinking and collaboration skills. Teaching materials can also include learning approaches that contain material, methods, and evaluations that will be made systematically to attract student attention. One of the teaching materials that can be developed is an interactive digital module.

Interactive digital modules are media or teaching materials that are accompanied by tools or controllers so that they can be operated by users and allow users to choose what they want for the following process. Agustina et al. (2021) said that digital modules are teaching materials that have interactive properties as learning resources and allow them to be used independently; this makes students more accessible and flexible in learning. Digital modules are attractive and will interest students because they contain interactive aspects. Navigation buttons, games, and practice questions are interactive aspects of this module.

Several studies focus on making interactive digital modules. However, there needs to be research on the development of interactive digital modules based on team game tournaments, such as those conducted by Rohmatulloh et al. (2023), who developed Interactive E-Modules based on problem-based learning (PBL) to improve students' mathematical critical thinking. In addition, research was also conducted by Dewi & Lestari (2020) who developed a project-based interactive E-Module to assess student learning outcomes. Therefore, this opens up opportunities for researchers to develop interactive digital modules based on team game tournaments using respiratory system material. The respiratory system was chosen as the material for

developing this interactive digital module because the respiratory system is considered quite difficult for students to understand. Research conducted by Candrasari (2022) states that the level of student response to human respiratory system material 62.15% of students in grade VIII SMP Negeri Sidoarjo experience misconceptions about the concepts of structure and function of the human respiratory system, respiratory mechanism, respiratory system, respiratory rate, and disorders that occur in the respiratory system. Learning tools or teaching materials and learning methods are the contributing factors.

This research aims to develop an interactive digital module based on the problem description and the empirical evidence presented. This research aims to produce valid, practical, and effective teaching materials to improve students' critical thinking and collaboration skills.

B. Material and method

This development research uses the 4D model. This model consists of 4 stages, namely: (1) Define, (2) Design, (3) Development, and (4) Disseminate (Thiagarajan et al., 1974). This development flow can be seen in Figure 1.

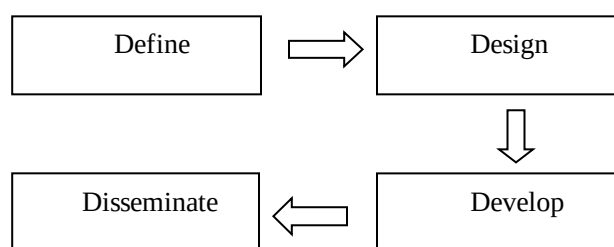


Figure 1 4D model design

The test subjects in this study were 11th-grade students of Madrasah Aliyah Laboratorium UINSU. The instruments used in this study were interview guides for teachers and questionnaires for students used to collect data about the problems and needs of interactive digital teaching materials. In addition, the validity of the TGT-based interactive digital module is measured through a validation sheet consisting of a teaching material expert validation sheet and a material expert validation sheet used to collect data on learning media reviews from validators. Then, the practicality sheet determines the teacher and student's responses to the TGT-based interactive digital module. The measurement scale for each indicator on the teacher and student response validation sheet is measured using a Likert scale with a score of 1-4.

The research data obtained were qualitative data and quantitative data. Qualitative data was obtained based on the results of interviews with teachers and criticisms and suggestions from

validators. At the same time, quantitative data was obtained in the form of assessment scores from validators, teacher and student response questionnaires, as well as critical thinking skills scores and student collaboration skills scores. The data obtained were then analyzed and processed descriptively, qualitatively, and quantitatively. Data on the validity of TGT-based interactive digital modules are obtained from the expert validator assessment scores. At the same time, practicality data is obtained from teacher and student assessment scores. Quantitatively, the data that has been obtained is then analyzed to obtain data calculated using Formula 1. Then, the results of the data analysis of the validity and practicality of the module are interpreted using the criteria in Tables 1 and 2.

$$\text{Percentage (100\%)} = \frac{\text{score obtained}}{\text{score maximum}} \times 100\% \dots \text{Formula 1}$$

Table 1 Validation assessment results criteria

Percentage (%)	Criteria
80.00-100.00	Very valid
60.00-79.00	Valid
50.00-59.99	QuiteValid
00.00-49.99	Invalid

(Source: Riduwan & Akdon, 2010)

Table 2 Practicality assessment results criteria

Percentage (%)	Criteria
81-100	Very practical
61-80	Practical
41-60	Quite practical
21-40	Not Practical

(Source: Riduwan & Akdon, 2010)

Meanwhile, data on the effectiveness of TGT-based interactive digital modules are obtained from the scores obtained from the observation of the assessment of collaboration skills and students' critical thinking skills. The criteria for the effectiveness of TGT-based interactive digital modules in developing collaboration skills refer to Table 3, obtained using Formula 2.

$$P = \frac{\text{score obtained}}{\text{score maximum}} \times 100\% \dots \text{Formula 2}$$

Table 3 Collaboration assessment results criteria

Percentage (%)	Criteria
90-100%	Very effective
70-89%	Effective
50-69%	Effective enough
30-49%	Less Effective
10-29%	Very Ineffective

(Source: Erni, 2016)

TGT-based interactive digital modules' effectiveness in improving students' critical thinking skills is obtained using the N-Gain calculation on Formula 3. The interpretation of the results of the N-Gain calculation refers to Table 4.

$$N\text{-Gain} = \frac{\text{posttest scores} - \text{pretest scores}}{\text{maximum value} - \text{pretest score}} \times 100\% \dots \text{Formula 3}$$

Table 4 Criteria N-Gain

Gain value	Criteria
$g > 0.7$	High
$0.3 < g < 0.7$	Currently
$G < 0.3$	Low

(Source: Nasution & Rasyidah, 2022)

C. Results and discussion

This development research produces TGT-based interactive digital modules on respiratory system material that can be accessed via smartphone or computer. The TGT-based interactive digital module was created to develop students' collaboration and critical thinking. This module was developed through 4 stages based on the 4D model. The following explains the findings of the stages of developing interactive digital modules in this study.

1. Define

The defining stage consists of five main steps: initial analysis, student analysis, concept analysis, task analysis, and learning objective analysis. This stage is intended to recognize and define the requirements in the learning process.

a. Front End Analysis

Front-end analysis is an analysis of the background of development research. At this stage, observations were made regarding the learning process carried out in biology at Madrasah Aliyah Laboratorium. This analysis was carried out using interview sheets and questionnaires to analyze the needs of teachers and students. The observation results show that students are allowed to bring smartphones to school for learning purposes. Also, the learning process still uses the 2013 curriculum, teachers still use the lecture method, and learning at school still uses textbooks. In addition, the teacher mentioned that students need to familiarize themselves with interactive digital modules as teaching material, so it is essential to develop interactive digital modules.

b. Student Analysis

Student analysis was conducted to understand the characteristics of students. Findings from the student needs analysis questionnaire showed that the biology learning experience could have been more interesting. The results showed that students preferred something other than the learning methods and

materials used by the teacher. Students also agree to conduct development related to the development of interactive digital modules needed for ongoing learning activities. Then, this analysis obtained the total score of students' critical thinking through the pretest test, with an average of 57.83% from 26 students. The results of the observation of collaboration skills showed a score of 61.

c. Concept Analysis

Concept analysis aims to systematically identify, define, and organize the material to be developed in an interactive digital module by biology learning. This analysis is to develop learning objectives and essential parts to be learned and compile relevant material based on basic competencies. After the analysis, the material developed in interactive digital modules based on TGT is the respiratory system class XI material. The human respiratory system material to be developed is contained in KD (Basic Competencies) 3.8, namely analyzing the relationship between the structure of the tissues that make up the organs in the respiratory system about bioprocesses and functional abnormalities that can occur in the human respiratory system with indicators of competency achievement, namely 1) Identify the structure of the tissues that make up the organs in the

human respiratory system. 2) Explain the functions of the organs that play a role in the human respiratory system. 3) Explain the mechanism of bioprocesses in the human respiratory system. 4) Analyze functional disorders that occur in the human respiratory system. The learning objectives to be achieved are that students can identify the structure of the tissues that make up the organs in the human respiratory system, students can explain the functions of the organs that play a role in the human respiratory system, and students can explain the bioprocess mechanisms in the human respiratory system.

d. Task Analysis

This task analysis aims to see suitable activities to be carried out by students to achieve the basic competencies of the developed KI (Core Competencies) 4. This analysis is done by making tasks by KD 4.8, namely analyzing the effect of air pollution on abnormalities in the structure and function of human respiratory organs based on literature studies. The tasks given to students are carried out in the form of groups. Students are asked to make infographics about the impact of air pollution on the human respiratory system. Learning activities according to IPK (Competency Achievement Indicators) are as Table 5.

Table 5 Competency achievement indicators

KD	IPK
4.8 Analyze the effect of air pollution on abnormalities in the structure and function of human respiratory organs based on literature studies.	4.8.1 Analyze functional disorders that occur in the human respiratory system 4.8.2 Present the results of an analysis of the effect of air pollution on the structure and function of human respiratory organs.

e. Analysis of Learning Objectives

The formulation of learning objectives produces indicators of competency achievement related to the Basic Competencies of KI 3, namely Understanding, applying, analyzing factual, conceptual, procedural knowledge based on his curiosity about science, technology, arts, culture, and humanities with insights into humanity, nationality, statehood, and civilization related to phenomena and events, as well as applying procedural knowledge in specific fields of study in accordance with his talents and interests to solve problems and Basic Competencies of KI 3, namely Understanding, apply, analyze factual, conceptual knowledge of nationality, statehood, and civilization related to phenomena and events, and apply procedural knowledge in specific fields of study in accordance with their talents and interests to solve problems and Basic Competencies of KI 4, namely Processing, reasoning, and presenting in the concrete domain and abstract domain related to the development of what he learns at school independently, and is able to use methods according to scientific principles so as to produce learning objectives that can be achieved.

The learning objectives to be achieved in this TGT-based interactive digital module are:

- 1) Students can identify the structure of the organs tissues in the human respiratory system.
- 2) Students can explain the functions of organs that play a role in the human respiratory system.
- 3) Students can explain the mechanism of bioprocesses in the human respiratory system.
- 4) Students can analyze functional abnormalities that occur in the human respiratory system.
- 5) Students can present the results of the analysis of the effect of air pollution on abnormalities in the structure and function of human respiratory organs.

2. Design

In the design stage, TGT-based interactive digital module design is carried out. This stage aims to prepare teaching materials consisting of several components, including cover, preface, table of contents, KI and KD, instructions, concept map, learning objectives, material, games based on TGT syntax, exercise questions, answer keys, bibliography, glossary, and author biography. After that, in the next

stage, the design of research tools is carried out in the form of expert validation sheets to assess the feasibility aspects of interactive digital modules, teacher and student response instruments to determine the practicality of interactive digital modules, observation sheets for collaboration skills, and pretest post-test grids to see the effectiveness of interactive digital modules. At this stage, the design or planning of the TGT-based interactive digital module display is also carried out in the form of color gradations, image and video layouts, interesting info, and title frames using the Canva application. The next step is to provide hyperlinks to each command button that has been determined. After everything is done and completed, the next step is to share the Canva link in display mode, and the TGT-based interactive digital module can be used and accessed online by students using a smartphone.

3. Develop

The TGT-based interactive digital module development stage validates interactive digital modules. The validation assessment was conducted to determine the validity of the interactive digital module developed by the researcher. Media and material validators carried out validation; the media and material validation results can be seen in Tables 6 and 7. Media expert validation obtained a total assessment of 205 out of a maximum score of 208

with a percentage of 98.55%, which was declared very valid. Validation conducted by material experts resulted in 89 ratings out of a maximum score of 92, with a percentage of 96.73%, which indicates that it is very valid. Nevertheless, both media and material experts suggested improving the TGT-based digital interactive module, detailed in Figures 2, 3, and 4.

After the teaching materials are valid, a small-scale trial is carried out by distributing questionnaires containing teacher and student responses. Table 8 shows the results of the teacher response questionnaire with an average score of 97.92% in the aspects of interest, material, and language, which shows that the feasibility of the product is classified as very practical. Likewise, the results of the student response questionnaire conducted on 10 students and presented in Table 9 obtained a score of 93.15%, which was also classified as very practical. The TGT-based digital interactive module developed looks feasible for students to use in the learning process while helping students learn in the digital era. The high practicality of this module comes from various factors. First, this interactive digital module is straightforward for educators and students to use in learning. This aligns with research conducted by Suastrawan et al. (2021), which states that the practicality of teaching materials or learning media depends on how easily teachers and students can utilize them in the learning process.

Table 6 Media expert validation results

No.	Section name	Score obtained	Maximum score	Percentage	Criteria
1.	Aspects of module completeness	100	100	100%	Very valid
2.	Quality aspects of e-module interactive	66	68	97.05%	Very valid
3.	Presentation and graphic aspects	39	40	97.5%	Very valid
Amount		250	208	98.55%	Very valid

Table 7 Material expert validation results

No.	Section name	Score obtained	Maximum score	Percentage	Criteria
1.	Aspects of Content Suitability	27	28	96.42%	Very valid
2.	E-module quality aspects	32	32	100%	Very valid
3.	Presentation and graphic aspects	30	32	93.75%	Very valid
Amount		89	92	96.73%	Very valid

Table 8 Teacher response questionnaire results

No.	Section name	Score obtained	Maximum score	Percentage	Criteria
1.	Aspect of interest	20	20	100%	Very practical
2.	Material aspects	15	16	93.75%	Very practical
3.	Language aspect	12	12	100%	Very practical
Amount		47	48	97.92%	Very practical

Table 9 Results of student response questionnaires

No.	Section name	Score obtained	Maximum score	Percentage	Criteria
1.	Aspects of Content Suitability	342	360	95%	Very practical
2.	Aspects of Linguistic Appropriateness	216	240	90%	Very practical
3.	Aspects of graphic feasibility	299	320	93.43%	Very practical
Amount		857	920	93.15%	Very practical

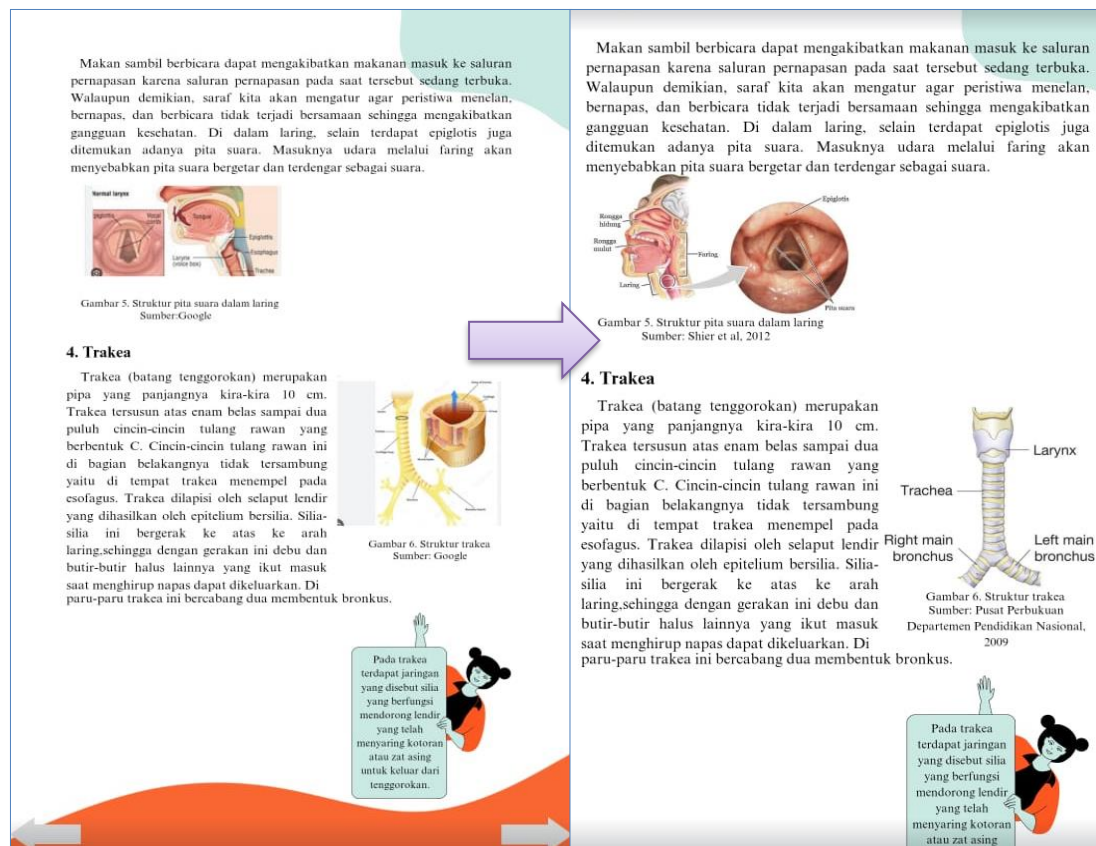


Figure 2
Improved image from the validator's suggestion so that the image is not blurry (in Indonesian)

Untuk menambah pengetahuan tentang mekanisme pernapasan, yuk kita simak video berikut!!

3. Kapasitas Paru-Paru

Kapasitas paru-paru merupakan kemampuan paru-paru menampung udara pernapasan. Udara yang dihirup oleh tubuh dapat diklasifikasikan menjadi :

- Udara tidal**, yaitu udara yang keluar masuk paru-paru pada saat pernapasan biasa. Volume udara yang masuk dan keluar adalah 500ml.
- Udara komplementer**, yaitu udara yang masih dapat dihirup setelah inspirasi biasa. Besar volume yaitu 1,5 liter.
- Udara suplemen**, yaitu udara yang masih dapat dikeluarkan setelah ekspirasi biasa. Besar volume udaranya sekitar 1,5 liter.
- Kapasitas vital paru-paru**, yaitu kemampuan paru-paru untuk melakukan respirasi sekuat kuatnya. Besar volume kapasitas vital paru-paru kurang lebih 4 liter.
- Udara residu**, yaitu udara yang masih terdapat di paru-paru setelah melakukan respirasi sekuat-kuatnya. Besar volumenya kurang lebih 500ml.
- Kapasitas total paru-paru**, yaitu seluruh udara yang dapat ditampung oleh paru-paru.

Untuk menambah pengetahuan tentang kapasitas paru-paru yuk simak video di samping!

Contoh Soal

1. Perhatikan data volume udara pernapasan berikut!

No	Jenis udara pernapasan	Volume(mL)
1	Udara pernapasan	500
2	Udara komplementer	1.500
3	Udara cadangan	1.500
4	Udara residu	1.000

Berdasarkan data tersebut, volume udara yang dapat dihirupkan semaksimal mungkin setelah melakukan inspirasi secara maksimal adalah?

Pembahasan :

Perlu diketahui volume udara yang dapat dihirupkan semaksimal mungkin setelah melakukan inspirasi secara maksimal disebut kapasitas vital. Kapasitas vital merupakan volume udara tidal (pernapasan biasa) ditambah volume cadangan inspirasi (udara komplementer) dan volume cadangan ekspirasi (udara suplemen). Jadi dapat diketahui, kapasitas vital paru-paru berdasarkan soal tersebut adalah 3.500 mL (500+1.500+1.500).

2. Perhatikan data volume udara pernapasan berikut ini :

Kapasitas vital paru-paru=4.550 mL
Volume tidal=530mL
Volume residu=750mL

Berdasarkan data tersebut, kapasitas total paru-paru adalah?

Pembahasan:

Untuk mencari kapasitas total paru-paru maka Kapasitas vital ditambah volume residu
4.550mL + 750mL = 5.300 mL
Jadi kapasitas total paru-paru adalah 5.300 mL

Figure 3

Picture the results of improvements from the validator's suggestion to add examples of questions about the vital capacity of the lungs in the vital capacity of the lungs material section (in Indonesian)

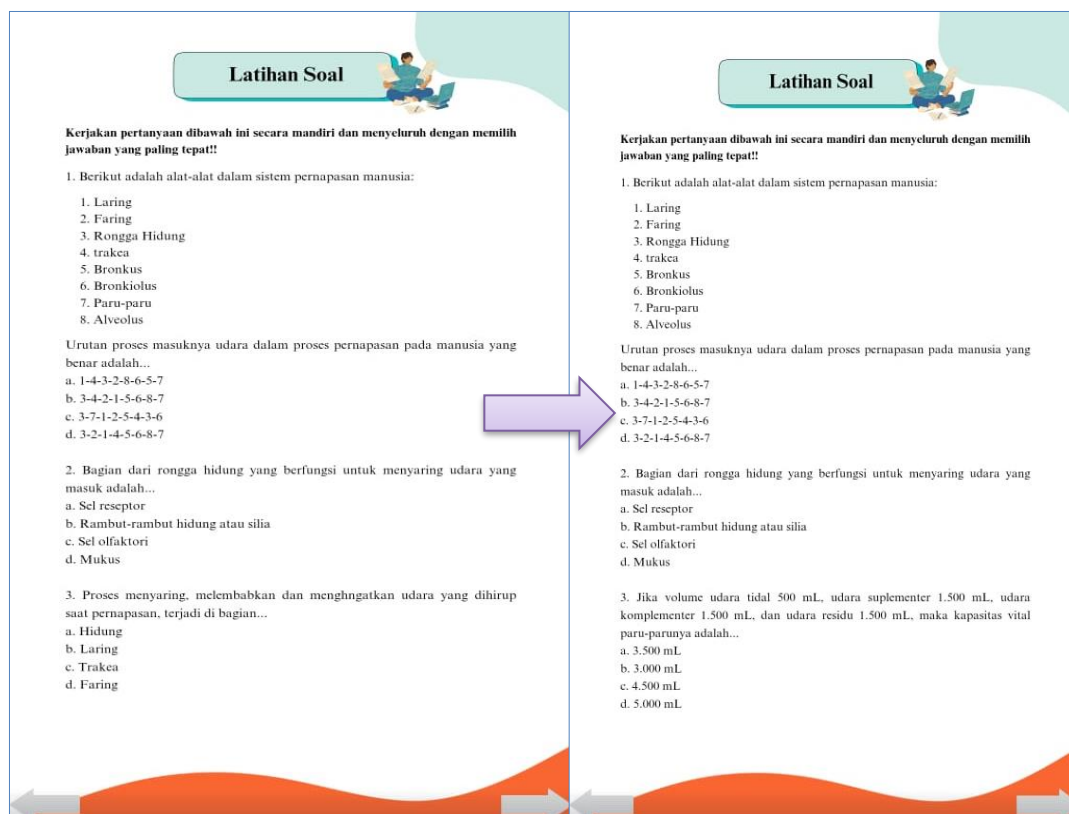


Figure 4

Picture of the improvement results from the validator's suggestion to add questions about lung vital capacity in the exercise questions (in Indonesian)

4. Disseminate

The product can be widely disseminated after revisions to the aspects of teaching materials, and materials are made and tested on a small scale. This product was distributed at the UINSU Laboratory Madrasah Aliyah Laboratory, namely in class XI MIA 2. This trial was conducted to evaluate its effectiveness. The effectiveness of the TGT-based interactive digital module was proven through pretest-posttest analysis to measure students' critical thinking skills (Figure 5) and observations of collaboration or cooperation skills (Figure 6) before and after product application. To see the effectiveness of students' critical thinking skills can be seen in Table 10. The results of the N-Gain calculation showed that students' pretest scores were lower than their post-test scores, with an average N-Gain value of 0.80, which indicates a high category level. In addition, Figure 5 presents each indicator of critical thinking skills, showing varying results between the pretest and post-test results. This shows that the interactive digital module impacts students' critical thinking skills. By using the TGT-based interactive module, students can develop interpretation skills. The interpretation indicator in students' critical thinking involves understanding and interpreting information carefully and sincerely.

The TGT syntax in the interactive digital module can make students work in teams to solve problems or complete specific tasks. This process

requires understanding and interpreting information presented in the context of a given problem. Students need to analyze information, identify existing problems, and interpret the relationship of the information to get the right solution. In addition, developing this interactive digital module can improve analytical skills. With a tournament in the form of an online game in this module, students need to analyze the opponent's strategy, identify the opponent's weaknesses, and evaluate the best steps to defeat him. This process requires careful analysis of the available information and the ability to make the right decision based on the analysis. This is in line with research conducted by Ningtyas & Rahayu (2022), which states that analytical skills improve by using online media. This is because online media or teaching materials allow students to analyze more broadly and thoroughly. In another study conducted by Wulandari et al. (2023), it was stated that the use of digital media in the form of Moodle, an online media, effectively attracts students' attention so that students can analyze the learning process. This is due to students' interest in the material presented in the digital media. However, what makes this research different is the type of media used. The media to be developed is a digital interactive module that contains several more exciting features. This is what will increase students' ability to analyze.

Table 10 Student's critical thinking skills

Pretest	Post-test	N-Gain	Percentage	Criteria
57.53	91.73	0.80	80%	High

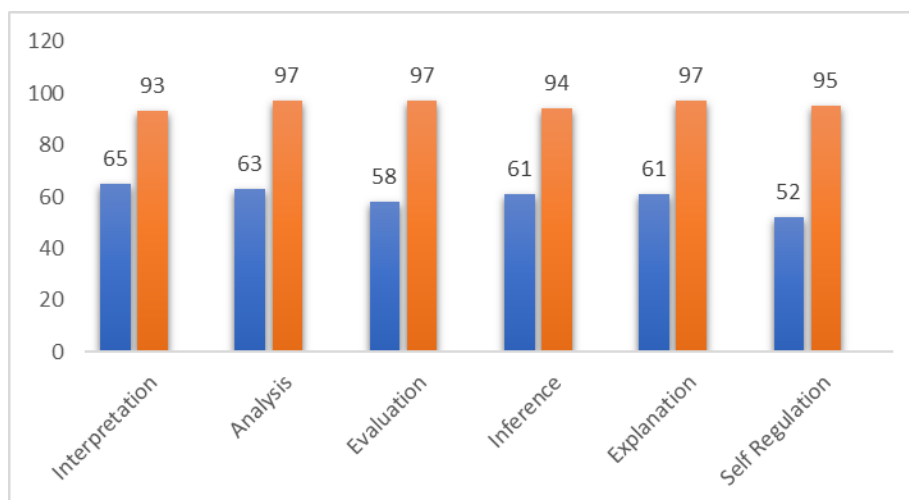


Figure 5 Diagram of recapitulation of student pretest and post-test results based on critical thinking indicators

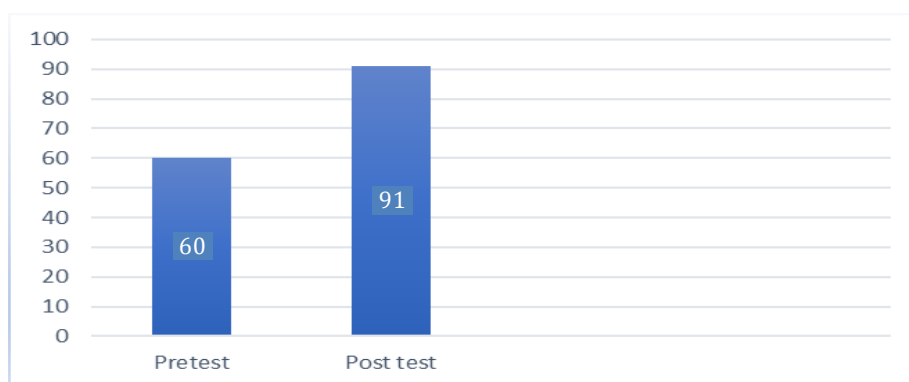


Figure 6 Diagram of students' collaboration skill

Related to the evaluation indicator, this interactive digital module can help students develop the ability to evaluate. As stated in the tournament syntax, they need to evaluate the results once the game is over critically. This includes identifying successful and unsuccessful strategies, evaluating team performance, and considering decisions made during the game. Then not only that, but this TGT-based interactive digital module can also develop students' inference skills. Inference is an essential process in critical thinking that involves the ability to make inferences, draw conclusions, or make assumptions based on existing information (Dewi & Putu, 2023). In the TGT syntax contained in the digital interactive module, students work in teams to solve problems or complete specific tasks. During this process, they must use inference to connect their information, draw conclusions, or make necessary assumptions.

Furthermore, it affects inference skills. Creating this interactive digital module can also improve the

ability to provide explanations. In TGT syntax, students work in small groups to solve problems or complete tasks. This discussion process allows students to share their understanding of the topic being studied actively. Through this discussion, students can elaborate on their ideas and understand the perspectives of others, like the research conducted by Adawiyah et al. (2022), which explains that good critical thinking skills are inseparable from students' attitudes in learning activities, including those who show a conscientious attitude and work together. Thus, they can develop the ability to explain concepts or information in more detail. Finally, with the development of this interactive digital module, students' self-regulation ability will also be affected. This ability is the ability to control and regulate their thinking process effectively. This is supported by the opinion of Bustami et al. (2022) that the learning process using TGT syntax can help students in mastering their learning concepts. This is because, in the syntax of TGT, students collaborate in groups to

achieve learning objectives. This process involves setting a common goal at the beginning of the learning session. Students learn to organize and set goals with other team members through teamwork. This helps them develop the ability to plan and set their own goals, which is part of self-regulation in critical thinking.

Meanwhile, students' collaboration skills also showed improvement. It can be seen in Figure 6. It is shown that before using the TGT-based interactive digital module, students' collaboration skills scored 60. However, after applying the TGT-based interactive digital module, it increased by scoring 91. Thus, this shows that the TGT-based interactive digital module effectively improves students' collaboration skills.

The effectiveness shown from the pretest and post-test results or before and after the implementation of TGT-based interactive digital modules shows that this product can be a valuable tool for learning in the classroom because using TGT-based interactive digital modules makes students more active and improves relationships between students so that cooperation is established in solving existing problems. In addition, the tournament in this TGT-based interactive digital module energizes students because a game accompanies the tournament in this TGT-based interactive digital module. This can create solidarity between students because of the learning group.

This is to the results of research conducted by Anwar et al. (2015) showing that using teaching methods based on the TGT learning model can increase cooperative accountability, reduce student dependence on the teacher, develop the ability to express ideas and ideas, and increase activeness in learning. Erviani et al. (2022) also said that the TGT learning model is a type or model that is easy to implement and involves the activities of all students without any status differences, involves the role of students as peer tutors, contains elements of play, allows students to learn to relax in addition to fostering responsibility, cooperation, healthy competition, and learning involvement. Later, this TGT learning model can build students' mindsets to think critically, creatively, and innovatively.

Based on this, this digital interactive module can be used as a supporting material for learning in the classroom because using this teaching material makes students more active in learning and affects their critical thinking process. In addition, by using this teaching material, students' ability to work together also increases because of the TGT syntax contained in this digital interactive module. As said by Lestari et al. (2022), using this learning model can increase cooperation between students in solving problems, help students increase positive traits in learning, help students accept other students' opinions, and make students learn more actively. However, this teaching material still has limitations,

such as the limitations in the learning activities section contained in the digital module, which is still a manual process. For further research, working on all activities in the module can be done automatically and directly. Not only that, this interactive digital module requires additional applications such as Word Wall to be able to access the games contained in this module and the YouTube application to watch the material presented, and this interactive digital module is also limited to respiratory system material. Therefore, the researcher's suggestion for further research can expand the material in class XI biology learning that has yet to be covered in the development of this interactive digital module.

D. Conclusion

Based on the research that has been conducted, the TGT-based digital interactive module is an effort to create valid, practical, and effective teaching materials designed to improve students' collaboration and critical thinking skills in the context of respiratory system material. Product development in digital interactive modules based on TGT principles is considered teaching material that is feasible and appropriate to improve students' critical thinking and collaboration skills. However, this development research still has limitations, such as the limitations in the learning activities section contained in the digital module, and the process still needs to be revised. For further research, working on all activities in the module can be done automatically and directly. Another limitation is that this interactive digital module requires additional applications, such as Word Wall, to access the games contained in this module. In addition, the YouTube application to watch the material presented and this interactive digital module is also limited to respiratory system material. Therefore, the researcher's suggestion for further research can expand the material in class XI biology learning that has yet to be covered in the development of this interactive digital module.

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