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Development of Interactive Student's Worksheets to Improve Mathematical HOTS of Tenth Grade Students in Trigonometry Topic

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ABSTRACT

It is undeniable that Higher Oder Thinking Skills (HOTS) have become the center of attention and essential skills needed, especially in mathematics today, but there are so many research shows that the average thinking ability of Indonesian students is still low. One of the student's low thinking abilities cause is teaching materials that still dominated by questions in the Low Order Thinking Skills (LOTS) category. Therefore, this study aims to develop valid, practical, and effective interactive student worksheets to improve tenth-grade students' higher-order thinking skills. This research used Research and Development (R&D) designs and methods guided by the ADDIE development model with five steps: Analysis, Design, Development, Implementation, and Evaluation. The data obtained from this study is quantitative and qualitative data, which was obtained from the interview, validation test sheet, students and teacher response sheet and pretest-posttest result. The assessment from experts from both the material and media shows that the worksheet is valid with 4.30 and 3.97 average scores. Furthermore, based on the questionnaire responses of teachers and students with the "Excellent" score category, it shows that the developed interactive student worksheet is practical. The interactive student worksheet is also effective in improving mathematical HOTS of tenth-grade students since there is a significant increase in students' mathematical higher-order thinking skills based on student learning outcomes with 0.64 value of N-Gain. Besides the N-Gain, the students' response through the learning after using the interactive worksheet was also in the "Excellent" category, with an average score of 4.54 in the small trial and 4.27 in the field trial. Therefore, this study has produced a valid, practical, and effective interactive student worksheet to improve tenth-grade students' mathematical Higher Order Thinking Skills (HOTS).

Keywords: HOTS, Interactive Student's Worksheet, Research and Development (R&D)

ABSTRAK

Tidak dapat dipungkiri bahwa kemampuan berpikir tingkat tinggi (HOTS) telah menjadi pusat perhatian dan keterampilan esensial yang dibutuhkan, khususnya dalam matematika saat ini, namun masih banyak penelitian yang menunjukkan bahwa rata-rata kemampuan berpikir siswa Indonesia masih rendah. Salah satu penyebab rendahnya kemampuan berpikir siswa adalah bahan ajar yang masih didominasi soal-soal dengan kategori Keterampilan Berpikir Tingkat Rendah (LOTS). Oleh karena itu, penelitian ini bertujuan untuk mengembangkan LKPD interaktif yang valid, praktis, dan efektif untuk meningkatkan kemampuan berpikir tingkat tinggi matematis pada siswa kelas X. Penelitian ini menggunakan desain dan metode *Research and Development (R&D)* dan berpedoman pada model pengembangan ADDIE dengan lima langkah yaitu Analisis, Desain, Pengembangan, Implementasi, dan Evaluasi. Data yang diperoleh dari penelitian ini adalah data kuantitatif dan kualitatif yang diperoleh dari wawancara, lembar tes validasi, lembar respon siswa dan guru serta hasil pretest-posttest. Penilaian ahli baik dari materi maupun media menunjukkan bahwa LKPD valid dengan skor rata-rata 4,30 dan 3,97. Selanjutnya berdasarkan angket tanggapan guru dan siswa dengan kategori skor "Sangat Baik" menunjukkan bahwa LKPD interaktif yang dikembangkan bersifat praktis. LKPD interaktif juga efektif dalam meningkatkan HOTS matematis siswa kelas X karena terdapat peningkatan yang signifikan kemampuan berpikir tingkat tinggi matematis siswa berdasarkan hasil belajar siswa dengan nilai N-Gain 0,64. Selain N-Gain, respon siswa melalui pembelajaran setelah menggunakan LKPD juga masuk dalam kategori "Sangat Baik" dengan skor rata-rata 4,54 pada uji coba kecil dan 4,27 pada uji coba lapangan. Oleh karena itu, penelitian ini telah menghasilkan LKS interaktif yang valid, praktis, dan efektif untuk meningkatkan kemampuan berpikir tingkat tinggi (HOTS) matematis siswa kelas X.

Kata kunci: HOTS, LKPD Interaktif, Penelitian dan Pengembangan (R&D)

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Introduction

One of the mathematics' cognitive aspects that have become the center of attention and an important skill needed nowadays is Higher Order Thinking Skills (HOTS). Students of mathematics education programs with a high level of HOTS are expected to succeed in their next study since there is a linear, positive and strong relationship between HOTS and the GPA (Grade Point Average) of students (Tanujaya et al., 2017). Therefore, HOTS has become an important skill needed in learning mathematics. However, many research results still show that students tend to have low thinking skills in mathematics. For example, the Program for International Student Assessment (PISA) 2018 results show that only 1% of Indonesian students can reach level five or higher in mathematics, and some 28% of students still attain level two or higher (Markus, 2019). Level two means students can only interpret and recognize a simple mathematical situation. In contrast, level five means students can select, compare and evaluate appropriate problem-solving strategies conducted in the HOTS indicator. There are three main cognitive process dimensions in HOTS, C4 (Analyze), C5 (Evaluate), and C6 (Create) (Anderson et al., 2001). Therefore the PISA result shows only 1% of indonesian students can reach the higher order thinking skills indicato. Another research also found that the students of senior high schools in Indonesia tend to have low thinking skills, especially in mathematics learning (Widana, 2018).

One of the causes of the low students' mathematical HOTS is the lack of learning resources and sample questions. Generally in Indonesia, the assessment of mathematics only tends to test the ability to remember, calculate the formula, and apply the mathematical concept to a particular problem that is routine, which is still in low-order thinking skills categories (Widana, 2018). If this condition continues, it will be very difficult for students to activate their high-level thinking skills in mathematics. Although the activation of HOTS can be done in various ways, one of the ways to activate the HOTS is by revising textbooks used in mathematics learning because it should provide examples and practice tests that can promote students thinking skills (Tanujaya et al., 2017). Therefore, every school needs to facilitate students with textbooks or other teaching materials that contain the HOTS example and assessment to improve their higher-order thinking skills, especially in mathematics.

A student's worksheet is a teaching material containing many examples and assessments. In general, student worksheets are a set of papers containing information and questions about the materials (Hasanah, 2012). It is also equipped with instructions and steps to complete the task or question according to the competencies. Therefore, by using the student's worksheet, teachers can provoke students to be actively involved in the learning process so that the topic discussion will be more active (Rahayu, 2018). Furthermore, students' learning activeness through the student worksheets containing HOTS questions will certainly help students develop their mathematical HOTS with direct experience.

The method of presenting teaching materials also has a big influence on increasing students' HOTS. Currently, Indonesia is starting to implement limited face-to-face learning in several regions of Indonesia due to the Covid-19 pandemic. The short study time then becomes an obstacle for students to participate in learning actively. This student's inactivity will certainly affect students' thinking abilities as well. Therefore, we need an innovation such as interactive learning media. *Interactive learning media* is multimedia that can describe the message from teacher to student in a two-way communication process (Sahronih et al., 2019), which allows students to improve their HOTS wherever, whenever, even without a teacher. One of the

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interactive multimedia applications makers that teachers or students can use is the articulate storyline. The articulate storyline can be a good choice for teachers in developing interactive teaching materials such as student worksheets since it is easy to use, also easy to publish, and access because it can be accessed via the internet and can be accessed either on a computer or smartphones (Nabilah et al., 2020).

Besides all the descriptions above, another research also showed that the average of students HOTS who use the HOTS worksheet is higher than those who do not (Isra Khasyyatillah & Irianti, 2018). The instructional design using the HOTS approach in creating the problem and question is effective for improving students' HOTS (Apino & Retnawati, 2017). Interactive media can be a suitable and feasible medium for learning (Nabilah et al., 2020). From all the literature studies above, it is known that developing interactive student worksheets that can improve mathematical HOTS is necessary. Therefore, this study aims to develop valid, practical, and effective interactive student worksheets to improve tenth-grade students' higher-order thinking skills.

Research Methods

This research was carried out by referring to the Research and Development method with the ADDIE development model. The ADDIE model is simple but also effective and systematic in the implementation. It is also in a line with (Siswati et al., 2021) which produces an LKPD that is valid and suitable for use by students as one of the teaching materials using the ADDIE model. The ability to use the ADDIE model in the development of teaching materials is also demonstrated in another research which produces a valid, practical and effective math set game in improving the critical thinking skills of students of the set material (Nurjanah, 2022). ADDIE is an acronym for Analyze, Design, Development, Implementation, and Evaluation is one of the product development concepts (Branch, 2009).

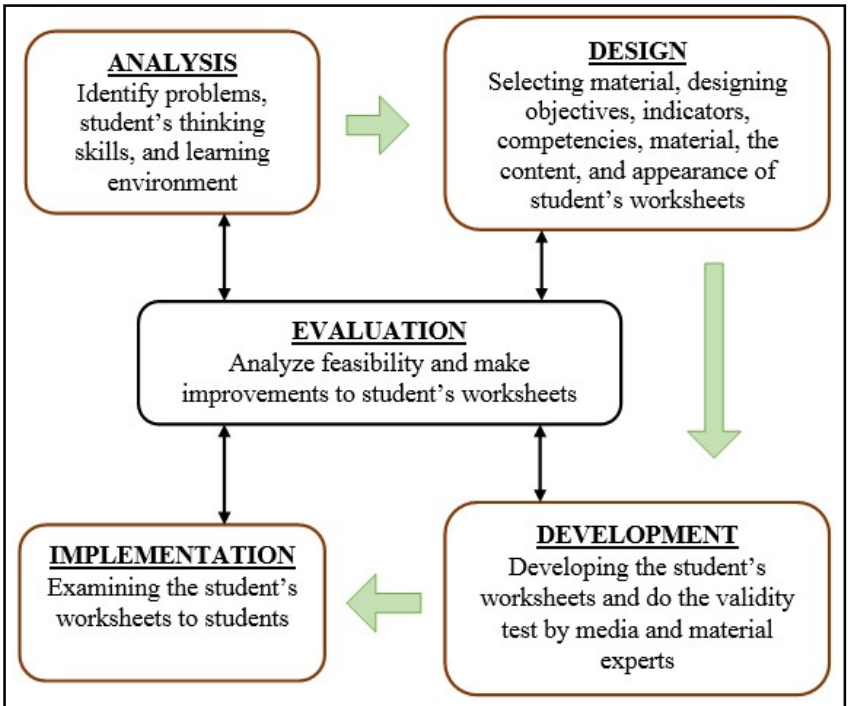

Figure 1. ADDIE model research steps

This research was conducted in SMA Negeri 1 Laubaleng, one of the public senior high schools in the Province of North Sumatra, Indonesia. It involved 54 students in two classes of tenth grade. The research was conducted since February until June 2022, with a product development period of three months and a month trial for students and teachers. In developing a learning device, quality becomes a crucial consideration. There are three quality criteria for academic's product development from a typology of curriculum representation that is valid, practical, and effective (Nieveen, 1999). Therefore, the valid, practical, and effective criteria of the developed interactive student's worksheet are compiled and modified based on (Nieveen, 1999), as shown in Table 1.

Table 1. The valid, practical, and effective criteria of the developed interactive student worksheet

Quality	Criteria
Valid	a. The results of the assessment from experts indicate that the interactive student's worksheet developed is based on the latest knowledge or materials (Material validation) b. The results of the assessment from experts indicate that the components of the interactive student's
Practical	a. The teacher stated that the interactive worksheets developed were possible to apply b. Students stated that students could use the developed interactive worksheets in learning
Effective	a. Get students' appreciation and positive responses to learning b. There is an increase in students' higher-order thinking skills through improving student learning outcomes

To analyze the quality of the developed interactive student worksheet, the researcher used several instruments in this study, such as two validation sheets, namely, the media validation sheet and the material validation sheet, two kinds of response instruments were used each for students and teacher, the pre-test and post-test with HOTS indicator as shown in Table 2.

Table 2. The grid of instruments for the Higher Order Thinking Skills test

Levels of Thinking Skills	Indicator	Question Number	Question Form
C4 Analyze	Students can group relevant, important, and needed information in problem-solving	1	Essay
C4 Analyze	Students can attribute the main problem to the suitable material in problem-solving	2	Essay
C5 Evaluate	Students can examine the suitability of created problem-solving strategies	3	Essay
C6 Create	Students can design strategies to solve problems	4	Essay

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Table 3. Five-scale quantitative data conversion guidelines

Interval Score	Category
$\bar{x} > 4,2$	Excellent
$3,4 < \bar{x} \leq 4,2$	Good
$2,6 < \bar{x} \leq 3,4$	Enough
$1,8 < \bar{x} \leq 2,6$	Bad
$\bar{x} \leq 1,8$	Very Bad

With $\bar{x}$ = Average Score

All the questionnaire instruments in this study used the Likert scale with 1 to 5 scoring scale. Furthermore, to convert quantitative data obtained through questionnaires into qualitative data, this study uses five-scale quantitative data conversion guidelines from the five-scale assessment conversion formula (Sukardjo, 2005), which is shown in Table 3. Based on Table 3 the developed Interactive students' worksheets were said to be valid, practical, and get a positive response if the average of the results of the questionnaire answers given by experts, teachers, and students is at least in the "Good" category or in the range of $3,4 < \bar{x} \leq 4,2$. The researchers also used the normalized gain average score (N-gain) developed by Hake (1998) to analyze the pretest-posttest data. The Normalized gain average score was then interpreted using the criteria as shown in Table 4 (Hake, 1998).

Table 4. The N-Gain criteria interpretation

Score	Criteria Interpretation
$\langle g \rangle \geq 0.7$	High
$0.3 \leq \langle g \rangle < 0.7$	Medium
$\langle g \rangle < 0.3$	Low

Description: $\langle g \rangle$ = Normalized gain average score

Based on Table 4, the developed Interactive student's worksheet met the effective criteria if the N-Gain score obtained is at least in the "Medium" criteria.

Result and Discussions

This research and development produce valid, practical, and effective interactive student worksheets to improve the mathematical HOTS of tenth-grade students.

Analysis

Before choosing and designing the teaching material, researchers analyzed the needs and the problem that happened to the students. Based on the initial observation's result, students still make many mistakes in answering the HOTS questions given by the researcher. The diagnostic test result shows that among 25 tenth-grade students at SMA Negeri 1 Laubaleng, ten students tended to have low levels of thinking skills, nine students had extremely low levels of thinking skills, and only six students had higher-order thinking skills levels. After interviewing the students, researchers found some aspects that influence the student's thinking skills, students did not have other supporting facilities such as student worksheets or other learning media. In addition, the learning process still uses the teacher-center method, which made the involvement and activeness of students in learning and building knowledge independently still lacking. Also the textbook use in the learning process still contain Lower Order Thinking Skills (LOTS).

Therefore, the interactive student's worksheets that contain HOTS question neccesary to developed.

Design

After analyzing the identification of problems, needs, and conditions of the learning environment experienced by students, the researcher then continues to the design stage. Based on the needs from the analysis stage, the researcher chose to develop students' worksheets as the learning material to solve identified problems. The steps taken by the researcher at this stage are:

1. Select the used materials and sources in the student's worksheet.
2. Designing the objectives, indicators, and competencies in the student's worksheets according to the higher-order thinking skills approach.
3. Designing the student's worksheets material display.
4. Choosing the type of media.
5. Designing the appearance and content of the student's worksheets.
6. Prepare assessment instruments for students' worksheets such as media validation test, material validation test, teacher and student response sheets, and higher-order thinking skills test questions for students. The entire preparation of this instrument was carried out to collect data in the development research carried out.

Development

The researcher developed student worksheets following the prepared conceptual design in the development stage. After being developed, the experts validated the material and media of students' worksheets. The researcher then improves the student's worksheet based on suggestions from experts. In the material validation instrument, there are four aspects considered there are content, presentation, language, and HOTS assessment aspect. The results of material validation are present in Table 7.

Table 7. Material validation result

Assessment Aspect	Average
Content feasibility	4,25
Presentation feasibility	4,35
Language feasibility	4,35
HOTS Assessment	4,25
Average	4,30

In a media validation instrument, there are three considered aspects: appearance, attractiveness, and ease of use. The results of media validation are present in Table 8.

Table 8. Material validation result

Assessment Aspect	Average
Appearance	4,21
Attractiveness	4,12
Ease of use	3,58
Average	3,97

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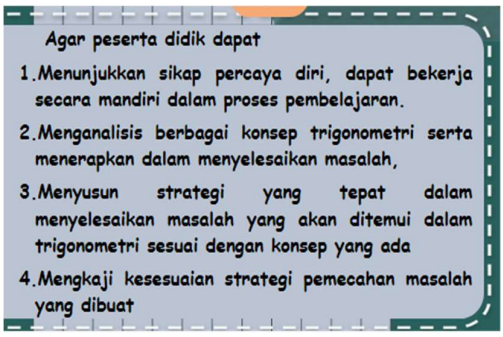
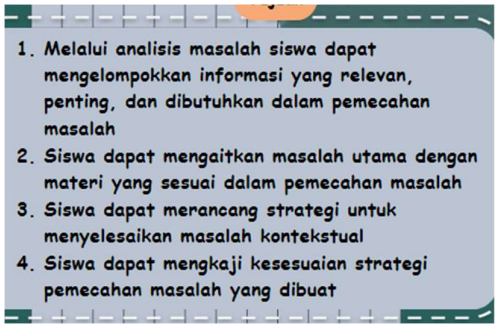
The material validity test shows an average score of 4.30 showing the material presented in the interactive student's worksheet in the "Excellent" category according to Table 3. This category means that in content, presentation, language, and HOTS aspect, the material used in the interactive worksheets were based on the latest material and knowledge so that it is very appropriate and suitable for the tenth grade of senior high school students. The results of the media validation test conducted by four media experts showed an average score of 3.97, so the worksheets developed in the form of interactive media are in the "Good" category based on the conversion in Table 3. The average score shows that the interactive worksheet components developed are consistently related, making them feasible and suitable for use by tenth-grade high school students.

The assessment results of experts consisting of two teachers and two lecturers in the field of mathematics show that the interactive LKPD developed is based on up-to-date knowledge and the components are consistently developed. Therefore, the developed interactive worksheets are valid for use, but one expert declares the interactive student's worksheet valid with revision. Based on suggestions from material experts, there were a revision through the learning objectives of the developed interactive student's worksheet. The results of the improvements are present in Table 9 below.

Table 9. Material revision result

Before revision		So students can 1. Show a confident attitude, can work independently in the learning process 2. Analyze various trigonometric concepts and apply them in solving problems 3. Develop appropriate strategies for solving problems that will be encountered in trigonometry according to existing concepts 4. Examine the suitability of the problem-solving strategy made
After revision		1. Through problem analysis, students can classify information that is relevant, important, and needed in problem-solving 2. Students can relate the main problem to the appropriate material in problem-solving 3. Students can design strategies to solve contextual problems 4. Students can examine the suitability of the problem-solving strategies made

Implementation

The researcher conducted trials on students' worksheets developed and validated by the experts' team in the previous step at the implementation stage to see the practicality and effectiveness of the student's worksheets. Therefore, the researcher carried out two trial steps in this stage: a small group trial and a field trial. In small group test trials, the researcher involves ten senior high school students and two mathematics teachers from SMA Negeri 1 Laubaleng. The results of student responses in the small group trial are present in Table 10.

Table 10. Student's response in the small group trial

Aspect	Average Score
Learning appreciation through the worksheet	4,54
Ease of use worksheet's	4,61
Average	4,59

Furthermore, the results of the teacher's response questionnaire are presented in Table 11.

Table 11. Teacher's response

Aspect	Average
Interest	4,66
Material	4,00
Language	4,25
Average	4,31

After revising the interactive student's worksheet based on the results of small group trials, the researcher conducted a large-scale study of tenth-grade students at SMA Negeri 1 Laubaleng by involving44 students. The results of the student response questionnaire are presented in Table 12

Table 12. Student's response in the field trial

Aspect	Average Score
Learning appreciation through the worksheet	4,27
Ease of use worksheet's	4,23
Average	4,24

Furthermore, the researcher tested the student HOTS through a one-group pretest-posttest validated in advance by experts. The N-Gain results of the pretest-posttest are present in Table 13.

Table 13 N-Gain result in the field trial

Class	Average Pre-test Score	Average Post-test Score	N-Gain	Category
Class 1	13.04	70.21	0.66	Medium
Class 2	19.04	70	0.63	Medium
Average	15.91	70.11	0.64	Medium

Based on the teacher's response, the interactive student's worksheet developed was in the "Excellent" category with a 4,31 average score (Table 11), which means the student's worksheet is useable for the tenth grade of high school students. Furthermore, student responses to the

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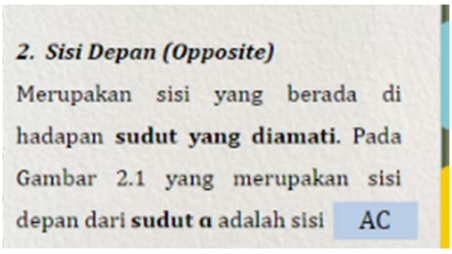
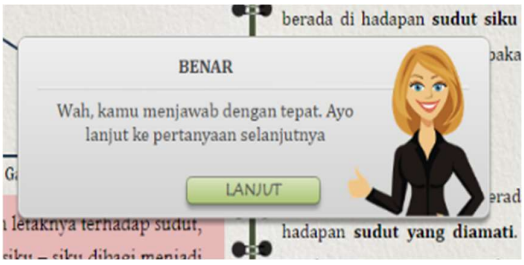
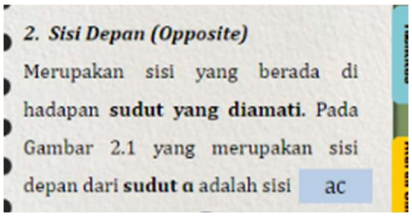
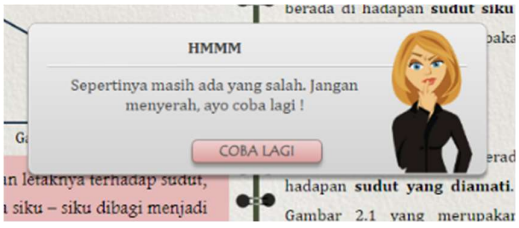
ease of use interactive student worksheets aspect are also in the "Excellent" category with an average of 4,61 in the small group trial and 4,23 in the field trial (Table 12). Therefore, with the average score generated from the student and teacher responses results, it can be concluded that the interactive student worksheet developed is very practical for tenth-grade students from every aspect, such as material raised and presented and the language used in delivering the material.

The results of student responses showed that students felt more enthusiastic, motivated, and not bored in learning mathematics after using the developed interactive worksheets. It is shown from the average student answer score of 4.54 in the small trial and 4.27 in the field trial. These two average values are still the same as being in the "Excellent" category based on the conversion guide. The pretest and post-test results showed that from class 1, the N-Gain value was 0.66 with the "Medium" category and the N-Gain results in class 2 1 of 0.63 with the "Medium" category. Furthermore, the average N-Gain value generated from all students who became the subject of the study was 0.64, with the "Medium" category (Table 13). Thus, the interactive worksheets significantly affect tenth-grade students' HOTS. Therefore, the developed interactive worksheets are effective because they significantly increase students' HOTS and get a positive response from students.

Evaluation

At this evaluation stage, the researcher analyzed the results found in each step to decide on the continuation of the research and the need for revisions to the student's worksheets. Evaluation is carried out at every stage of the study.

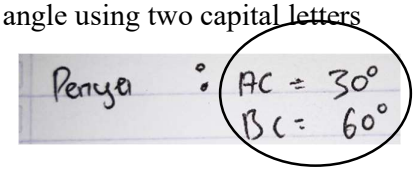
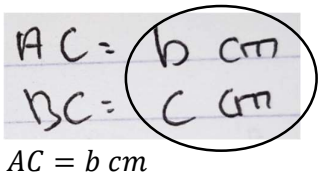
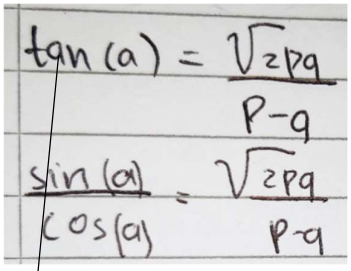
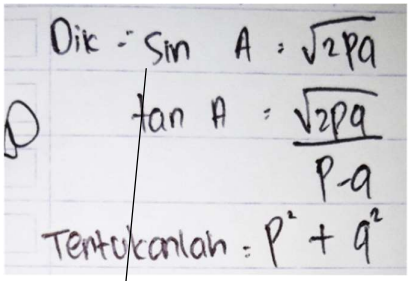
Table 14 Auto-correction demonstrate by students

Student's Answer	Worksheet's Display
	
Students give the name of the front side of a triangle using capital letters (AC) (True writing name of the side)	The worksheet assesses students' answers and gives a positive reaction so that students can continue their work.
	
Students give the name of the front side of a triangle using lowercase letters (ac) (wrong writing name of the side)	The worksheet assesses student answers and gives a negative reaction so that students can repeat their work.

The evaluation results are revisions carried out at each stage. Besides the achieved quality criteria, the study also shows that many students were attracted to this interactive student worksheet because of its attractive design, complete discussion, and equipped with tips and tricks for solving problems. In addition, the existence of auto-correction in the student's worksheet helps students find out whether the work they are doing is still wrong or correct, so they do not need to guess the truth of their respective answers.

From Table 14, the auto-correction system owned by the interactive student's worksheet developed not only considers the correctness or error of student answers but is also sensitive to writing errors such as the use of capital letters. This auto-correction system influences the way students answer the questions. As a result, students increasingly understand the basic concepts of writing the names of the sides and angles of a triangle. This understanding is seen in the change in how students answer questions in the pretest and post-test. So indirectly, the developed interactive worksheets also re-understand the basic concepts of writing side and angle names to students as important basic concepts that students must have in learning trigonometry. Examples of changes made by students can be seen in Table 15.

Table 15. Auto-correction system effect through students' understanding

Num	Pre-test Answer	Post-test Answer
1.	Students write the name of the angle using two capital letters  Known : $AC = 30^0$ $BC = 60^0$	Students already know that two capital letters are the names for the sides of a triangle  Known : $AC = b\ cm$ $BC = c\ cm$
2.	Students write the name of the angle using a lowercase letter  tan (a), sin (a), cos (a) are the wrong name.	Students already know that the naming of the angle in the sine uses a capital letter  tan (A), sin (A) are the true name

Interactive multimedia has several advantages, such as being able to be used independently by students, can accommodate some students who are slow in receiving lessons, and providing feedback as soon as possible (Munadi, 2013). The developed interactive worksheets also have the same effect on students. Students in the learning process have been able to use interactive

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worksheets independently. In addition, students have complete freedom in using the interactive student's worksheet; they can repeat the video they have watched and the answers that are still wrong due to the feedback given directly to the interactive student's worksheet. Therefore, students can develop their thinking skills independently through this student worksheet.

Conclusion

Based on the discussion of the research result, the assessment from experts shows that the worksheets is valid since contain up-to-date knowledge or material with consistently associated components. Furthermore, based on the questionnaire responses of teachers and students with an average score in category, it shows that the developed interactive student worksheet is practical. The interactive student worksheet is also effective in improving HOTS of tenth-grade students since there is a significant increase in students' higher-order thinking skills based on student learning outcomes. Student learning outcomes are in the "medium" N-Gain interpretation category. Apart from that, students' positive response to learning shows that the interactive student worksheet developed is also effective because it is in the "excellent" category. Therefore, the interactive worksheets developed are valid, practical, and effective in improving tenth-grade students' mathematical HOTS, especially in trigonometry material.

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Bibliography

Anderson, L. W., Krathwohl Peter W Airasian, D. R., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *Taxonomy for Assessing a Revision 0f Bloom's Taxonomy of Educational Objectives*. Longman.

Apino, E., & Retnawati, H. (2017). Developing Instructional Design to Improve Mathematical Higher Order Thinking Skills of Students. *Journal of Physics: Conference Series*, *812*(1). https://doi.org/10.1088/1742-6596/812/1/012100

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer US. https://doi.org/10.1007/978-0-387-09506-6

Hake, R. R. (1998). Interactive-Engagement Versus Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses. *American Journal of Physics*, *66*(1), 64–74. https://doi.org/10.1119/1.18809

Hasanah, A. (2012). *Pengembangan Profesi Guru.* Pustaka Setia.

Isra Khasyyatillah, Y., & Irianti, M. (2018). Development of Worksheet Based on High-Order Thinking Skills to Improve High-Order Thinking Skills of the Students. In *Journal of Educational Sciences* 2(1), 37-45. http://dx.doi.org/10.31258/jes.2.1.p.37-45

Markus, S. (2019). *The Programme for International Student*. OECD Publishing.

Munadi, Y. (2013). *Media Pembelajaran: Sebuah Pendekatan Baru* (Y. Munadi (Ed.)). Referensi.

Nabilah, C. H., Sesrita, A., & Suherman, I. (2020). Development of Learning Media Based on Articulate Storyline. In *Indonesian Journal of Applied Research (IJAR).* 1(2), 80-85. https://doi.org/10.30997/ijar.v1i2.54

Nieveen, N. (1999). *Prototyping to Reach Product Quality*. In J. Akker, R.M. Branch, K. Gustafson, N. Nieveen, T. Plomp (Eds), *Design Approaches and Tools in Education and Training* (pp. 125-135). Dordrecht: Springer.

Nurjanah, R. (2022). Development of Math Set Game to Improve Critical Thinking Skills Student of Class VII Material Set. In *AlphaMath Journal of Mathematics Education,* 8(1), 37. http://dx.doi.org/10.30595/alphamath.v8i1.13042

Rahayu, D. (2018). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Pemecahan Masalah Materi Bangun Datar. *Jurnal Mahasiswa Universitas Negeri Surabaya*. 6(3), 250. https://jurnalmahasiswa.unesa.ac.id/index.php/39/article/view/23506/21490

Sahronih, S., Purwanto, A., & Sumantri, M. S. (2019). The Effect of Interactive Learning Media on Students' Science Learning Outcomes. *ACM International Conference Proceeding Series*, *Part F148391*, 20–24. https://doi.org/10.1145/3323771.3323797

Siswati, T., Rezeki, S., Sthephani, A., & Marina Angraini, L. (2021). Development Student Worksheet Based on Problem-Based Learning (PBL) Development Student Worksheet Based on Problem-Based Learning (PBL) on Matrix Materials for Class XI. *AlphaMath: Journal of Mathematics Education,* 7(2), 100. http://dx.doi.org/10.30595/alphamath.v7i2.11842

Sukardjo. (2005). *Evaluasi Pembelajaran IPA* (Sukardjo (Ed.)). Program PPs UNY.

Tanujaya, B., Mumu, J., & Margono, G. (2017). The Relationship between Higher Order Thinking Skills and Academic Performance of Student in Mathematics Instruction. *International Education Studies*, *10*(11), 78. https://doi.org/10.5539/ies.v10n11p78

Widana, I. W. (2018). Higher Order Thinking Skills Assessment towards Critical Thinking on Mathematics Lesson. *International Journal of Social Sciences and Humanities (IJSSH)*. https://doi.org/10.29332/ijssh.v2n1.74

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