Development of E-LKPD oriented minimum competency assessment (MCA) on 6C's ability of high school students

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Abstract
Learning in the 21st century is currently required to be able to improve 6C's skills (collaboration, communication, creative thinking, critical thinking, computing, and affection). This study aims to produce MCA-oriented E-LKPD products on 6C's's abilities of high school students that are valid, practical and effective. The Research and Development research development method follows the four-D Model which consists of 4 stages of development, namely: define, design, develop, and disseminate. The research subjects were ten students of class XII at SMA Wachid Hasyim 2 Taman. Data collection techniques using questionnaires and post-tests. The data analysis used in this research is descriptive quantitative and qualitative analysis. The results of this study obtained the validity of the MCA-oriented E-LKPD on 6C's abilities from validation data filled in by material experts, media experts and practitioner experts with a score of 3.3; 3.5; and 3.5. In addition, the practicality of the MCA-oriented E-LKPD on 6C's abilities from the assessment of expert practitioners, namely teachers as users, gives a score of 3.5. While the effectiveness of the MCA-oriented E-LKPD on 6C's abilities from the results of trials on small groups of ten students obtained an average of 81.13% with a very effective interpretation. Based on the results of this study, the developed E-LKPD media met the expected validity, practicality and effectiveness criteria. So that it can be said that the MCA-oriented E-LKPD products on the 6C's abilities of high school students are valid, practical, and effective for use in learning.

INTRODUCTION

21st-century skills are often referred to as thinking skills, work skills, the ability to use technology and information, as well as life and career skills (Inganah et al., 2023; Jauhariyah et al., 2021). The thinking skills in question are *creativity and innovation* (Huda et al., 2018; Rudianto et al., 2022)*, critical thinking* (Darmayanti, et al., 2022; Morozova et al., 2022), *problem-solving* (Hu et al., 2018)*, decision making* (Meira et al., 2020)*, learning to learn, and metacognition* (Ahdhianto et al., 2020). On ability work namely c*ommunication* (Sugianto et al., 2022)*, collaboration and teamwork* (Bedir, 2019; Corbisiero-Drakos et al., 2021). The ability to use technology as a tool for work and use information as literacy (Zorlu & Zorlu, 2021). Also, life and career skills, namely *citizenship, local and global life and career, and personal & social responsibility, including cultural awareness and competence*. Education in the 21st century in Indonesia is expected to be able to give birth to a generation with 6C's capabilities (Kemdikbud, 2021). The 6C's capabilities in question are *critical* thinking, *creative* thinking*, communication, collaboration, computation, and *compassion* (Andriani et al., 2021; Fikri et al., 2020; Sari et al., 2021).

6C's ability is an ability that students must have as a student demand in the 21st-century era (Darmayanti, et al., 2022; Hasanah et al., 2022; Khalil, 2019). Stated in his research that the ability of the 6C's was able to form superior graduates according to the needs of the 21st

century. This was also conveyed in the development carried out (Kim et al., 2019) on developing interactive teaching materials containing 6C's on number pattern material for class VIII SMP that 82.12% of students were motivated in learning by using materials 6C's content interactive teaching. The ability of 6C's is urgent for education in the future, especially in the 21st century, this is in line with research conducted by (Fikri et al., 2020) and the perceptions of prospective PAI teachers on 6C's abilities in facing the 4.0 era. From the results of his research, it was revealed that the 6C's ability must be owned by prospective PAI teachers so that they become professional educators and can produce a generation of students who are at the level of developed countries. Being a developed country in global education, Indonesia should be able to raise the PISA *(The Program for International Student Assessment)* ranking which is currently at the bottom (Kemendikbud, 2019; OECD, 2010, 2014, 2016; Pratiwi, 2019). The Ministry of Education and Culture has prepared a tool for educational assessment to encourage an increase in the PISA ranking, namely through the Minimum Competency Assessment (MCA) (Pusmenjar, 2020).

Minimum Competency Assessment (MCA) there is a literacy and numeracy assessment that shows an orientation towards PISA. The MCA cognitive level shows the thought processes required or needed to be able to solve problems or questions (Pangesti, 2018). The cognitive process of reading literacy is from finding information, interpreting and integrating, as well as evaluating and reflecting (Aditama, 2022). Meanwhile, the process of cognitive numeration is the ability to understand, apply, and reason (Mena, 2016; Wardono & Kurniah, 2015). The context in MCA is a novelty in learning in the current era by showing aspects of life or situations for the content used. The context of MCA is divided into three, namely personal, sociocultural, and scientific (Hidayah et al., 2021; Miftah & Setyaningsih, 2022).

During the limited observation of the researcher as a teacher at SMA Wachid Hasyim 2 Taman. During the process of implementing the Final Semester Assessment (PAS) around 86% of students always passed questions in a scientific context and non-routine reasoning questions. After interviewing several students, information was obtained that they argued because the teacher had never taught them at school. What's more, when looking at the results of the National Examination in 2019 (Puspendik, 2019), students who were able to work on questions with an indicator of solving non-routine questions were only 3.85, and indicators for solving contextual problems were 6.5 on a scale of 100. As well as on the Geometry test material with an average of 34, 59 is the lowest compared to the Algebra, Calculus, and Statistics test material. Therefore, the learning process in the context of reasoning on non-routine questions becomes a habit in learning mathematics and solving problems in a context characterized by MCA.

Therefore, from the explanation above about 6C's and MCA capabilities, there is a need for innovation in classroom learning. Teachers play an important role in innovating to design learning in the classroom using teaching materials (Huda, 2020; Nasrum & Subawo, 2022). One part of the teaching materials contains a summary of the material, student activities and practice questions, namely LKPD (Student Worksheet) (Choirudin et al., 2021; Faiqoh et al., 2019; Ulandari & Mitarlis, 2021). According to (Apertha et al., 2018) stated LKPD is a complement to teaching materials or supports the means of making RPP (Learning Implementation Plan). Whereas the E-LKPD according to (Fitriyah & Ghofur, 2022) is material in the application accompanied by examples that feature student worksheets that must

be completed by individuals or groups to support understanding as well as students' critical thinking in solving problems.

LKPD is believed to be able to improve 6C's capabilities in the 21st century as was done by (Fitriyah & Ghofur, 2022; Istiqomah & Suparman, 2020; Lestari & Muchlis, 2021; Pratama et al., 2018; Wandari et al., 2018). However, the development of the E-LKPD that has been carried out by previous research is limited to one of the capabilities of the 6C's in question. LKPD developed by (Fitriyah & Ghofur, 2022; Lestari & Muchlis, 2021) limited critical thinking skills. Meanwhile, (Istiqomah & Suparman, 2020; Wandari et al., 2018) also develop worksheets to improve creative thinking skills. This is also corroborated by (Pratama et al., 2018) the fact that the LKPD is developed only on mathematical communication skills. MCA-oriented E-LKPD development research associated with 6C's capabilities has not yet been discovered by researchers.

Thus the development of the E-LKPD is a novelty because it includes 6C's capabilities. So the renewal in this study is a differentiator from previous research. Therefore, research on the development of MCA-oriented E-LKPD on the 6C's abilities of high school students is important to research. The purpose of this research is to produce an MCA-oriented E-LKPD product on 6C's capabilities that is practical, valid and effective.

METHODS

The type of research used is *Research and Development* (R&D). The model used in this study is the 4-D model *(Define, Design, Develop, and Disseminate)* developed by Thiagarajan, (1974). The 4-D model procedure is described in figure 1 below.
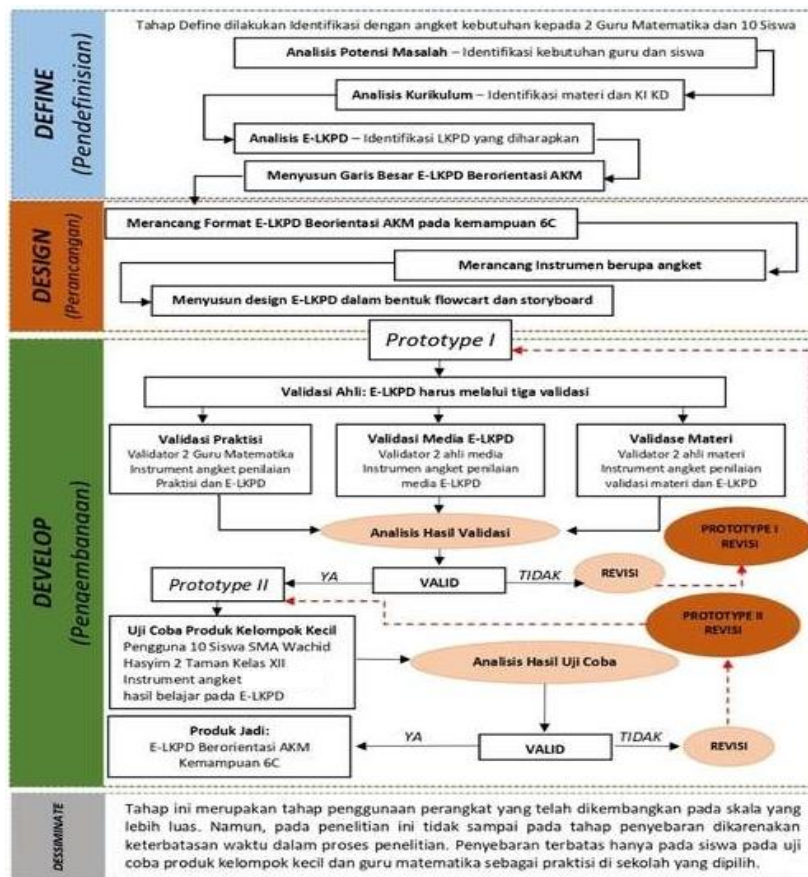

Figure 1. Development Research Flowchart

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The students who were the experimental subjects in this study were class XII students at SMA Wachid Hasyim 2 Taman for the 2022/2023 academic year who were also the population. The research sample was 10 people at the field trial stage. Sampling was carried out using a *simple random sampling* technique, which is a random sampling technique regardless of strata in the population.

Data collection techniques in this study were questionnaires and *post-tests*. Questionnaires are used as initial information and validators as well as assessments from expert practitioners, media and materials. The instrument in this development research was a questionnaire which was divided into 5 namely: (1) a questionnaire for the needs of teachers and students; (2) a material validator questionnaire; (3) a media validator questionnaire; (4) practitioner validator questionnaire; and (5) *post-test.*

The practicality and validity of data analysis are analyzed using the following formula. Per Aspect (Sudjana, 2012):

$$K = \frac{\Sigma X_i}{n}$$

Information :

K	: Total average
ΣX_i	: Total overall score per aspect
n	: Many points of the statement

While the guidelines for interpreting the results of this analysis are described in Table 1. below.

Table 1. Interpretation of Expert Validation Analysis Results

Average	Criteria	Decision
$3 \leq K \leq 4$	Valid/ Practical/	Products can be said to be valid/practical and do not need revision.
$2 \leq K \leq 3$	Less Valid/Practical	The product can be said to be less valid/practical with a little revision.
$1 \leq K \leq 2$	Invalid/Practical	Products can be said to be invalid/practical with many revisions.

(Widoyoko, 2013)

Analysis of the effectiveness of data from the questionnaire on the ability of *compassion and collaboration* as well as student learning outcomes using the E-LKPD. Meanwhile, the ability to *critical thinking, creative thinking, computational logic, and communication* from learning outcomes when learning using E-LKPD. Analyze the scores obtained by students with the formula (Sugiyono, 2015):

$$X = \frac{Skor}{Skor\ Maksimal} \ x \ 100\%$$

Table 2. The level of effectiveness of a product

Achievement percentage	Interpretation
76 – 100 %	Very effective
56 – 75 %	Effective
40 – 55 %	Less effective
0 – 39 %	Not effective

(Sugianto, 2014)

RESULTS AND DISCUSSION

The results of the research on the development of MCA-oriented Student Worksheets (LKPD) on 6C's abilities based on the 4-D model (Define, Design, Develop, and Disseminate) developed by Thiagarajan, (1974) will be presented below.

Define

At this stage, the initial research he carried out identified potential problem analysis, curriculum analysis, and LKPD analysis, and compiled the expected E-LKPD outline. At the potential problem analysis stage, the process of distributing questionnaires to the needs of teachers and students was carried out. In the questionnaire with respondents 10 teachers and 40 students at SMA Wachid Hasyim 2 Taman. The results of the needs analysis obtained a percentage of 82.2% for the teacher's needs analysis expecting an electronic-based LKPD that supports MCA and 84.6% of MCA-oriented LKPD learning on 6C's abilities.

Analysis of the needs of students obtained 83% motivated by digital or online-based learning because 100% of students already have mobile phones that are well connected to the internet. Thus, it can be concluded that both teachers and students need an MCA-oriented E-LKPD on the 6C abilities of high school students. In the analysis of the Core Competency (KI) and Basic Competency (KD) curricula which were adapted to the 2013 curriculum in the attachment to Permendikbud No.37 of 2018 used in MCA-oriented E-LKPD on the 6C's abilities of high school students in three-dimensional material. Based on the KI and KD, the results of the curriculum analysis are: (1) students can describe distances in space (between points, points to lines, and points to planes); (2) students can solve problems related to distances in space (between points, points to lines, and points to planes); (3) students can solve problems based on 6C's skill indicators in three-dimensional material.

E-LKPD analysis is carried out to obtain digital-based LKPD results that suit the needs and users. From the results of the initial needs questionnaire, 85% of teachers were familiar with using Google for Education such as Google Slides, Google Sites, Google Docs, and Google Forms. Therefore, the development of this E-LKPD will use Google for Education (google sites, slides, forms, and docs).

To prepare an outline of an MCA-oriented E-LKPD on 6C's capabilities that are in line with expectations, it is necessary to have MCA characteristics and components of 6C's capability indicators. Therefore, this research will develop E-LKPD which can be used as a learning media. electronic LKPD that can be used online or offline. MCA-oriented E-LKPD by inserting material related to scientific context, personal context, and socio-cultural context. As well as practice through the application of routine questions, and non-routine problem reasoning.

The MCA-oriented E-LKPD also includes 6C's capabilities. The 6C's capabilities referred to in this development research are *collaboration, communication, creative thinking, critical thinking, compassion and computation* (Andriani et al., 2021; Fikri et al., 2020; Sari et al., 2021).

Design

This stage includes the design of an MCA-oriented E-LKPD format for 6C's abilities in three-dimensional material for class 12 high school in storyboards, making the initial design and

preparing the material validation questionnaire instrument, media, materials and post-test preparation (learning outcomes).

1) Designing the E-LKPD format

The e-LKPD in question is Electronic Student Worksheets which can be done *online* and *offline*. Therefore, this E-LKPD is assisted by *Google Apps For Education* on *the platform (Google forms, slides, docs, sites)*. *Google sites* are used as a display platform just like websites or pages. *Google sites* are used as a collector of several platforms used. *Google forms* are used to dig up information data and collect the results of student activities that are done offline. *Google Slides* as *a platform for* answers from students' collaborative worksheets with a scientific context. *Google Docs* also serves as student activity sheets during enrichment or essay questions.

The MCA-oriented E-LKPD material is meant by literacy which includes student activities with a stimulus in a scientific, personal, and cultural context. The MCA-oriented E-LKPD is inseparable from the learning objectives that will be achieved according to basic competencies in the three-dimensional material for class 12 SMA. The basic competence in question is that students can explain the distance between points in space, and can determine the distance between points in space in solving problems.

Storyboard, from the development of MCA-oriented E-LKPD on 6C's capabilities for the following:

Figure 2. Storyboard of MCA Oriented E-LKPD on 6C's ability

2) Preparation of Instruments

This activity is carried out by making a questionnaire to validate the instrument, a questionnaire for material experts, design and media experts, and practitioner experts and a user trial questionnaire (post-test).

Develop

1) Product E-LKPD

At this stage, an MCA-oriented E-LKPD on 6C's capabilities is produced with the help of *google sites* which can be accessed at the following link: https://sites.google.com/view/e-lkpd-mat/

The front page of the E-LKPD consists of *a cover,* instructions for use, and the identity of the E-LKPD which consists of the name of the school, subjects, classes, material topics, sub-materials, core competencies, basic competencies as shown in Figure 3 below:
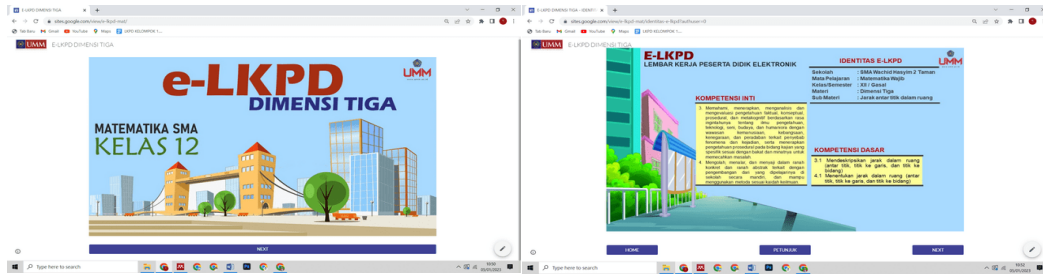
Figure 3. Front Page

Literacy page, on this page there are digital literacy activities for students to watch a video profile of an architect. This fits the personal context of MCA. Also, the activity of filling out a questionnaire about the ability of *compassion* is linked to *Google Forms* on *Google Sites* as shown in Figure 4 below:

Figure 4. Literacy Page

The prerequisite materials page in Figure 5 presents a personal context on the MCA regarding house building. Students are expected to be able to remember previous material about Pythagoras.
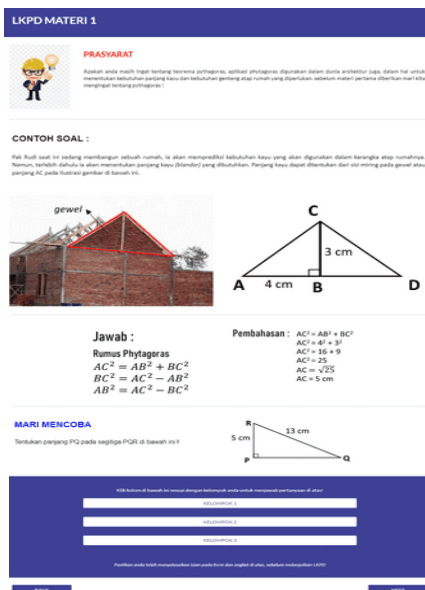

Figure 5. Prerequisite Material Page

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Activity page 1, in activity 1 student are faced with problems in the personal context of MCA. Students are invited to help solve problems in the given stimulus. This activity, activity can contain *collaboration* and *communication abilities*. In its application, the E-LKPD media in this activity uses *Google Slides* as an activity in a scientific context studying the distance of points in space according to three-dimensional material as shown in Figure 6.

Figure 6. Activity Page 1
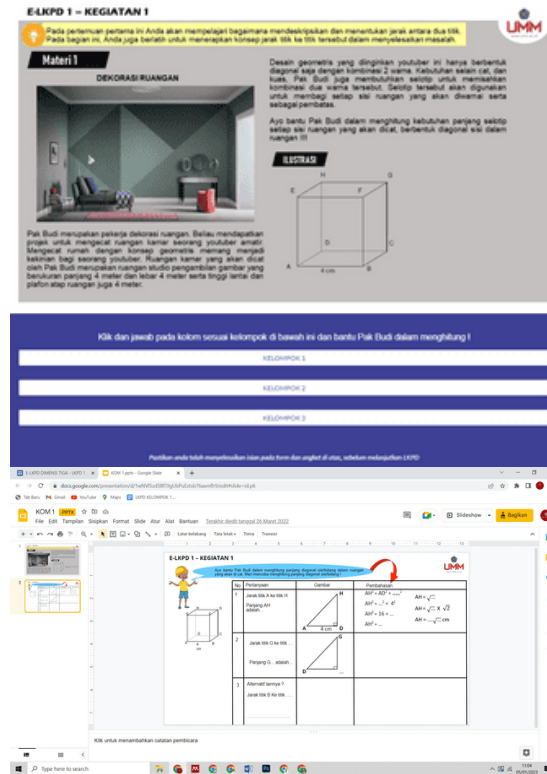
Activity page 2, the activities are still related to the personal context of MCA on the stimulus provided. Cognitive processes that students are expected to be able to understand and apply the concept of point-to-point distance in space and there is a load of *computational logic capabilities* in the activities in the E-LKPD as shown in Figure 7 as follows.

Figure 7. Activity Page 2

Practice Questions page, in this activity student work on practice questions, to measure cognitive processes in understanding and applying according to MCA. Also, this activity can contain *critical thinking abilities.* Also, the application uses *Google Docs* as an attachment to students' assignment answers as shown in Figure 8.
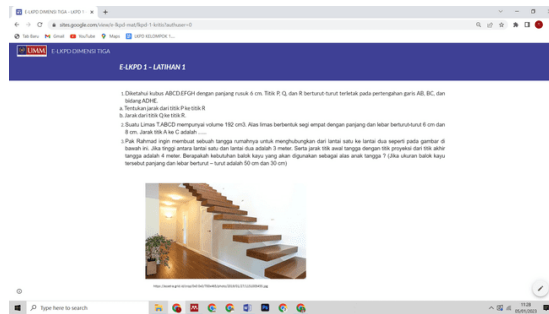

Figure 8. Question Practice Page

Enrichment page, in this activity students, is given problems according to real life in the cultural context of MCA, namely traditional houses. The cognitive process of reasoning in the problems given and being able to think *creatively* and be solved in groups in *collaboration*. The application used in this activity is *Google Forms* as shown in Figure 9 below.
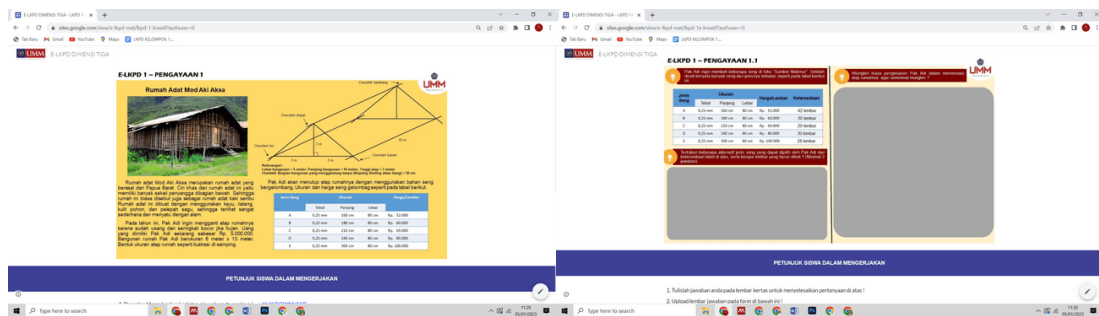

Figure 9. Enrichment Page

2) Expert Validation

The development of E-LKPD media products is carried out by expert validation, from practitioner validation to media validation, and material validation. Validation aims to produce a valid E-LKPD media to be tested on small groups. Apart from that, as an assessment of E-LKPD media, it is said to be valid by an expert validator. Meanwhile, an E-LKPD is said to be practical for practitioners, namely 2 math teachers. Furthermore, before the researchers conducted the research, this validation was carried out by several experts involving 2 teachers as practising experts and the same 2 mathematics lecturers as media and material experts. This research was conducted from 14 August to 20 August 2022.

Table 3. Expert Validation Results

Expert Practitioner		
Rated aspect	Average per aspect	
	X1	X2
Aspects of Media Use	3,6	3,4
Learning Design Aspects	3,25	3
Language and writing aspects	3.83	4
Average	3,6	3,5
Material Expert		
Rated aspect	Average per aspect	
	X1	X2
Learning Design Aspects	3,5	3,15
Content Aspect	3,62	3,25
Aspects of Language and Writing	3,14	3
Average	3.45	3,15
Media Expert		
Rated aspect	Average per aspect	
	X1	X2
Didactic Terms	3,4	3,2
Construction Terms	3,8	3,6
Technical Requirements	3,4	3,8
Average	3,5	3,5

Table 3 above, shows that the practicality assessment of an E-LKPD media by 2 expert practitioners obtained an average value of 3.55 with practical criteria. Meanwhile, the evaluation of an E-LKPD media by 2 material experts obtained an average value of 3.3 with valid criteria. This was also corroborated by the assessment of 2 media experts obtaining an average score of 3.5 with valid criteria.

3) *Product Trial*

Thus that the MCA-oriented E-LKPD media on 6C's capabilities can be said to be valid without revision. The subject was tried by 10 students of SMA Wachid Hasyim 2 Taman who were divided into 3 groups. The results of the product trial (post-test) or the learning outcomes of using the MCA-oriented E-LKPD on 6C's abilities through student activities when completing assignments on LKPD will be detailed on 6C's abilities according to the indicators below:

Table 4. Learning Outcomes On The Ability of *Compassion*

Compassion	Total Score		
	X1	X2	X3
self-kindness	28,20	25,64	25,64
common humanity	20,51	12.82	20,51
Mindfulness	28,20	25,64	28,20
Total score	76,92	64,10	74.35
Average Total Score	71,79		

From table 4 regarding the results of *compassion skills*, an average total score of 71.79% was obtained through a questionnaire on E-LKPD in digital literacy activities. Referring to table 2 regarding the level of effectiveness of a product. Thus, compassion ability results in effective interpretation. Thus, the use of MCA-oriented E-LKPD on compassion skills is effective.

Table 5. Learning Outcomes on *Collaboration Abilities*

Collaboration	Total Score		
	X1	X2	X3
Demonstrate the ability to work effectively and appreciate the diversity of the team	21,42	21,42	21,42
Demonstrates flexibility and a willingness to compromise with others in achieving common goals,	21,42	28.57	28.57
Take shared responsibility in working collaboratively and value the contribution of each team member.	42.85	42.85	35,71
Total score	85,69	92.84	85,70
Average Total Score		88.07	

From table 5 regarding the results of *collaboration abilities*, an average total score of 88.07% was obtained through a questionnaire on E-LKPD in digital literacy activities. Referring to Table 2 regarding the level of effectiveness of a product. So, the results of the ability to *collaborate* on interpretation are very effective. Thus, the use of MCA-oriented E-LKPD on effective collaboration capabilities.

Table 6. Learning Outcomes on *Communication Skills*

Communications	Total Score		
	X1	X2	X3
Presents visual images	25	20	25
State the mathematical formula	15	20	25
Clarify the problem	30	30	25
Solve the given problem	20	20	20
Total score	90	100	95
Average Total Score		95	

From table 6 regarding the results of communication skills, an average total score of 95% was obtained through a questionnaire on the E-LKPD in activity 1. Referring to Table 2 regarding the level of effectiveness of a product. So, the results of communication skills on interpretation are very effective. Thus, the use of MCA-oriented E-LKPD on communication skills is very effective.

Table 7. Learning Outcomes on *Computation Logic abilities*

Computational Logic	Total Score		
	X1	X2	X3
Abstractions	20	10	20
Algorithm	10	20	15
Decomposition	20	20	25
Generalization	25	20	15
Total score	75	70	75
Average Total Score		73,33	

From table 7 regarding the results of *computational logic capabilities*, an average total score of 73.33% was obtained through questionnaires on E-LKPD in digital literacy activities. Referring to Table 2 regarding the level of effectiveness of a product. Thus, the results of the ability of *computational logic* on interpretation are effective. Thus, the use of MCA-oriented E-LKPD on compassion skills is very effective.

Table 8. Learning Outcomes of *Critical Thinking Abilities*

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Critical Thinking	Total Score		
	X1	X2	X3
Analyze	30	33	30
Synthesize	20	22	25
Solve the problem	20	20	25
Conclude	10	10	5
Total score	80	85	85
Average Total Score		83,33	

From table 8 the results of *critical thinking skills* obtained an average total score of 83.33% which was done through a questionnaire on E-LKPD in digital literacy activities. Referring to Table 2 regarding the level of effectiveness of a product. So, from Table 8 regarding the results of *critical thinking skills* very effective interpretation. Thus, the use of MCA-oriented E-LKPD on critical thinking skills is very effective.

Table 9. Learning Outcomes of *Creative Thinking Abilities*

Creative Thinking	Total Score		
	X1	X2	X3
Fluency	20	30	30
Flexibility	20	25	20
Originality	20	20	20
Elaboration	10	10	5
Total score	70	85	75
Average Total Score		76,6	

From Table 9 regarding the results of *creative thinking abilities*, an average total score of 76.6% was obtained through a questionnaire on E-LKPD in digital literacy activities. Referring to Table 2 regarding the level of effectiveness of a product. So, the results of *creative thinking abilities* on interpretation are very effective. Thus, the use of MCA-oriented E-LKPD on creative thinking abilities is very effective. Meanwhile, the table of all 6C's capabilities is converted to the following diagram:
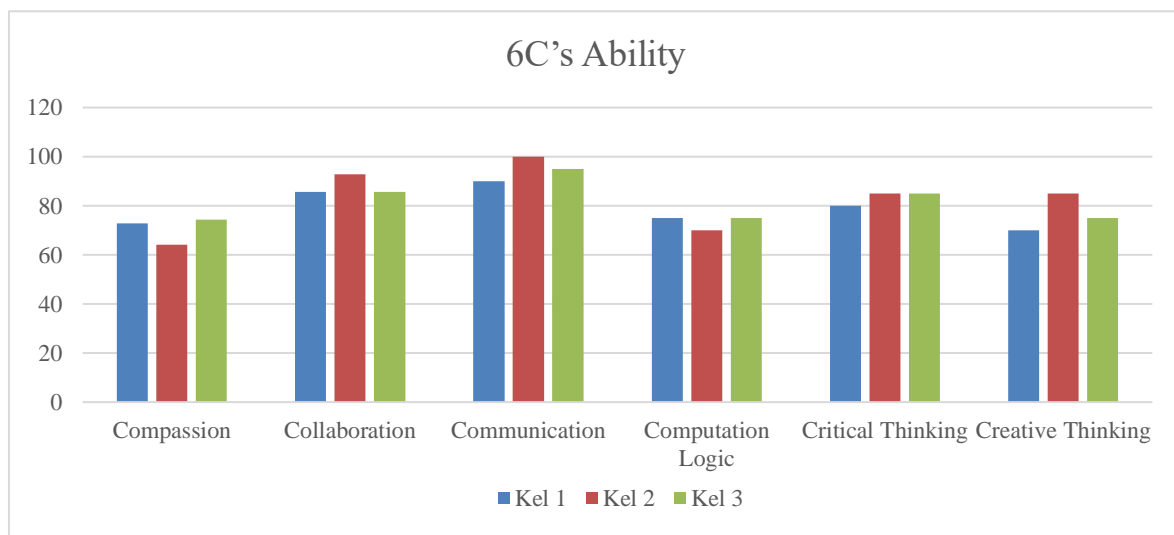

Figure 10. Results of The E-LKPD Trial on Ability 6C

From Figure 10, the results of the E-LKPD trial on 6C's ability have an average final total of 81.13%. This shows the development of MCA-oriented E-LKPD on 6C's capabilities with ***very effective interpretation.***

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4) E-LKPD

Based on the data obtained, the developed E-LKPD obtained valid criteria with a score of 3.3 from material experts and 3.5 from media experts. This is in line with research (Koderi et al., 2020) which states that the validity of an e-LKPD is determined by media experts and material experts. This research is the same as research conducted by (Andini et al., 2021)) where the results of the practicality test on the development of an E-LKPD were obtained from expert practitioners, namely mathematics teachers based on aspects of learning design, aspects of material content on objectives, and aspects of language and writing. Meanwhile, media experts with the categories of didactic, construction, and technical requirements are by the research conducted by (Septian et al., 2019) the development of Student Worksheets (LKPD) mathematics based on the *Realistic Mathematics Education model*. The didactic requirements in LKPD emphasize the process of finding a concept. Learning activities begin with giving problems by the teacher, then students solve them in their way. This is by the students' activities in finding concepts that are carried out when working on MCA-oriented E-LKPD on 6C's abilities.

According to (Widoyoko, 2013), E-LKPD can be said to be practical if the analysis obtains an average total (K) in the range $3 \leq K \leq 4$. The results of the data on the development of MCA-oriented E-LKPD on 6C's abilities get a total average of 3.55 with practical criteria. Practicality in the development of E-LKPD is also by the research conducted which (Manalu et al., 2017) state that practicality can be seen from the proper use of media. The aspect of media use is one of the assessment indicators in this development and research. This is because the use of E-LKPD media assisted by *Google Apps for Education (google sites, slides, docs, forms)* is familiar and easy for some teachers and students (Awuah, 2015). A research study conducted by Chiablaem, (2021) stated that *Google Apps for Education* (GAFE) on the *Google Docs platform* is very helpful in writing assignments. Lee & Hassell, (2021) state that the use of *google docs* can help students in writing collaboratively. Therefore, the use of *Google Docs* also helps in the E-LKPD assignment activities given by students in this study.

Google Apps for Education (GAFE) is an application or platform that is useful for education and learning in the classroom (Brown & Hoccut, 2015; Dias & Oliveira, 2022; Wibowo, 2022). In line with the opinion (Munawaroh & Sholikhah, 2022) that *google sites* with an attractive appearance and are easy to use in making websites instantly without having to learn a programming language. This is also justified by (Salsabila & Aslam, 2022) the use of *Google sites* as a website-based learning medium that is practical and easy to apply. *Google form* is a medium for quizzes and practices questions that are practically used by students (Nguyen et al., 2018). This statement is also reinforced by (Wahyuni & Tambunan, 2022) research that giving quizzes using *Google Forms* is very effective and practical for student learning outcomes.

5) E-LKPD on 6C's Capability

The results of the effectiveness of the MCA-oriented E-LKPD on 6C's abilities get the final average total for 6C's abilities getting 81.13% with a very effective interpretation. This

is in line with development research (Darmayanti & Sugianto, 2022) reveals that media decision-making is said to be effective from the results of the success of the ability being measured. In this development, the ability measured is 6C's.

The 6C's ability is a very important ability for individuals, especially in terms of meeting the demands of education in the 21st century. Students will be taught to identify problems and provide solutions through learning mathematics (Syaripuddin et al., 2020). Mathematics is defined as the eyes of students which are classified into the scope of Core Competency (KI) and Basic Competency (KD) in the eyes of students and cognitive skills when they are at the high school level of education which has a goal for the importance of having mathematical *6C's abilities* to prepare students to be able to solve math problems (Darwanto, 2019; Hendriana, 2017b; Sumarmo, 2014). The same thing is also mentioned in the appendix (Permendikbud, 2016a) that students through the 2013 curriculum orientation are expected to have *6C's abilities* as the goal of school education in general in learning mathematics. Furthermore, the same thing is contained in the appendix (Permendikbud, 2016b) which states that in cultivating *6C's* high school students, teachers must have skills in managing classes, designing conducive learning processes, and forming cognitive knowledge (Borrego et al., 2019; Goestjahjanti et al., 2020; Haamann & Basten, 2019; Lombardi, 2019; Rainsbury et al., 2002). *The 6C's ability* of a student's mathematics is the capacity to adapt and display positive behaviour so that in the end the person can deal successfully with the demands and problems of everyday life. The 6C's abilities that students must have to include *Critical, Collaboration, Communication, Creativity, Citizenship, and Character abilities.*

Through the development of media that is implemented in the form of an oriented *E-LKPD*, children can be more flexible in developing their skills, namely through a series of activities and practice questions (insert context in personal, socio-cultural and scientific context MCA) that are well designed and inserted. in materials and quizzes by including the *6C* indicators. So it can be seen that media development has a relationship with *E-LKPD* and *MCA* which will direct participants to develop *6C's abilities* in the form of *Critical, Collaboration, Communication, Creativity, Citizenship, and Character.*

Ramdani et al., (2019) stated in his research the importance of *collaboration skills* in creating a quality education system. This can be commensurate with the E-LKPD developed in this study which includes *collaboration capabilities*. The *collaboration* ability obtained in the MCA-oriented E-LKPD at an average total score of 88.07% is very effective. These results show that the E-LKPD can contain collaboration skills such as the research conducted (Octaviana & Wahyuni, 2022) regarding the development of E-LKPD to improve collaboration skills of junior high school students in the effective category. The effectiveness of learning on *collaboration* ability can be seen from the application of cooperative or group learning (Noviana et al., 2019).

The application of cooperative learning is also closely related to *communication skills* (Wahyuni, 2022). The results obtained from this development research on *communication skills* obtained an average total score of 95% with a very effective interpretation. Astuti & Leonard, (2012) states that the role of mathematical communication skills in mathematics learning achievement is very effective. Therefore, the implementation of MCA-oriented E-LKPD which includes *communication skills* is very important. This is in line with research

(Wulandari, 2022) which reveals that E-LKPD can improve *communication mathematics skills.*

The ability of *compassion* to balance oneself so that students can be kinder to themselves by suppressing the negative emotions they feel so that they are more able to focus on the goals they want (Afina & Munawaroh, 2022). Therefore, *compassion skills were* developed in the E-LKPD in this study. The results obtained an average total score of 71.79% with an effective interpretation. Based on the experience of researchers and reinforced by research conducted (Septiani, 2022) revealing psychological development, adolescents begin to form self-concepts to prepare for school at the next level. *Compassion* ability is important because the experimental subjects of this study were 12th-grade students who would prepare the goals and aspirations of future students.

Computational logic capability obtained an average total score of 73.33% with effective interpretation. The ability to *compute logic* is very important, especially in mathematics. *Computational logic* skills can help students learn to generate ideas, information and ways of thinking to improve their ability to analyze problems (Dwianika et al., 2021). C*omputational logic capabilities* can solve mathematical problems. This is in line with several previous studies (Alfina, 2017; Apriani et al., 2021; Kawuri et al., 2019; Rahmadhani & Mariani, 2021) state that solving mathematical problems can improve *computational logic abilities*. Therefore, the developed E-LKPD is effective in learning mathematics in class.

The cognitive process of application and reasoning requires *critical thinking* and *creative thinking abilities* (Anugrah & Pujiastuti, 2020; Hajar et al., 2018). Results in *Critical thinking ability* obtained an average total score of 83.33% with very effective interpretation. (Fitriyah & Ghofur, 2022) in research on the development of E-LKPD can increase the *critical thinking* of high school students, this is in line with this research. The same thing was also expressed by (Lestari & Muchlis, 2021) in their research that the E-LKPD is *contextual teaching and learning oriented* to train students' *critical thinking*. What's more, the development of *problem-based learning-based worksheets* assisted by *Google sites* is a stimulus for *critical thinking* (Munawaroh & Sholikhah, 2022). Thus, the developed E-LKPD is very effective according to the data obtained in this study and supported by previous literature reviews.

Meanwhile, on *creative thinking skills*, an average total score of 76.6% is obtained with very effective interpretation. MCA-oriented E-LKPD in personal, socio-cultural, and scientific contexts is in dire need of *creative thinking abilities* (Hidayah et al., 2021; Miftah & Setyaningsih, 2022; Pusmenjar, 2020). In previous research, it has been stated that E-LKPD on (Istiqomah & Suparman, 2020) *scientific*-based linear equation material can increase *creative thinking*. The development of MCA-oriented E-LKPD in the cultural context includes *creative thinking abilities*. This is in line with research conducted by (Wandari et al., 2018) on the Jambi culture-based LKPD development which can improve students' *creative thinking*. This is also reinforced by the opinion (Sari et al., 2017) that the developed E-LKPD contains local cultural content that can be made into a narrative as a stimulus. According to (Andini et al., 2022) Efforts to train *creative thinking skills* through E-LKPD based on *open-ended problems.* This is in line with the research being developed because the activities in the E-LKPD have *open-ended mathematical problems*. Therefore, MCA-oriented E-LKPD on creative abilities can be said to be ***effective***. So, from several

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opinions and research results that the MCA-oriented E-LKPD on the 6C's abilities of high school students can be concluded to be very effective.

CONCLUSIONS

Conclusion

Based on the results of this development research, it was obtained in the form of an MCA-oriented E-LKPD product on the 6C's abilities of high school students who met the valid, practical, and effective criteria so that it was suitable for use in learning mathematics, especially the three-dimensional material for class XII SMA. E-LKPD obtained valid decisions from material experts, media, and practitioners with an assessment of 3.3; 3.5; and 3.5. Meanwhile, on practicality decisions from assessments by expert practitioners with a score of 3.5.

The results of the effectiveness of the E-LKPD on the 6C's ability on *compassion skills* obtained an average total score of 71.79%. *Collaboration* ability obtained an average total score of 88.07%. Meanwhile, *communication* skills obtained an average total score of 95%. *Computational logic* ability obtained an average total score of 73.33%. *Critical thinking* ability obtained an average total score of 83.33%. Also, *creative thinking abilities* obtained an average total score of 76.6%. Thus the average final total for 6C's capability is 81.13% with a *very effective interpretation*.

Suggestion

Suggestions for further research as well as for future researchers to be able to develop the E-LKPD to the *disseminated stage*. Due to time limitations in the development of this research, it is only in the small group trial stage and has not been carried out for large groups. It is also advisable to conduct research on the development of E-LKPD with different materials. This is intended so that students are more helpful in understanding other learning materials

AUTHOR CONTRIBUTIONS STATEMENT

MS contributes in generating research ideas and designing them development of teaching materials based on mathematical modeling. RS and YM are responsible analyze and develop teaching materials and prepare product trials. All approve the final manuscript.

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