Development of Learning Tools Based on *Mind Mapping* Worksheet for Improving Stundents' Creative Thinking Skills on Cell Material

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Sections Info	ABSTRACT

Life skills-based education is an important tool to face today's global demands, one of which is creative thinking skills. This study aims to determine the feasibility of learning tools based on *mind mapping* worksheet to practice creative thinking skills for class XI MIPA on cell material, which are viewed in terms of (1) validity, (2) practicality and (3) effectiveness. The learning tools developed are syllabus, lesson plans, LKDP and tests of creative thinking skills. The *mind mapping* worksheet that was trained included indicators of creative thinking skills, fluency, flexibility, originality and elaboration, which were tested on 23 students of Class XI MIPA SMA Al-Islam Krian. This study used a 4D design with one group pretest-posttest design, the data obtained were analyzed descriptively. The results of the validity of the device get mode 4 with a very valid category. The results of the practicality of the device were carried out with mode 4 in the very good category. The effectiveness of the device is based on the average N-gain score ranging from 0.5 to 0.92. The result of students' mastery of the concept of the material is 86.3 in the complete category. Students' responses to the four LKPD mind mapping developed were 81% in the positive category.

INTRODUCTION

Life skills-based education, one of which is creative thinking skills, is an important means to prepare for global demands. A proper learning tool both theoretically and empirically is needed to train creative thinking skills. Creativity is a product of creative thinking. Creative thinking skills through *mind mapping* can assemble mental abilities that involve cognitive processes, personality characteristics, and environmental variables, as well as the interaction of other components to generate ideas that are useful in problem solving (Eratay, 2017). Learning through mind mapping strategies makes a positive contribution to the development of math and science skills (Polat et al., 2017). *Mind mapping* strategies in learning can activate the right and left brain lobes, meaningful and efficient learning, facilitate memory, become a form of practical presentation that is prepared in a short time, and increase students' interest, attention and motivation (Erdem, 2017).

The concept of the cell requires a constructed understanding of the process of assimilation to equilibration through a molecular approach to life phenomena related to the structure, function, and interrelationships between cell structure and function (Heni et al., 2017) Very broad cell material requires students to understand all learning content. A creative thinking learning device is needed to make it easier for students to

learn cell material. Challenging activities will encourage students to develop creative thinking skills *fluency, flexibility, originality* or *elaboration* to practice understanding, reasoning (reasoning), application of concepts and analytical thinking to solve problems. Based on the learning experience they have, students do not only master one ability but also three domains, namely; cognitive, affective, and psychomotor. The Student Worksheet (LKPD) is one of the teaching materials that has many advantages, namely making it easier for educators to carry out learning and students will learn independently and learn to understand and carry out written assignments (Marshel et al., 2020). LKPD is very effective for developing thinking skills and indicators of self-achievement (Susantini et al., 2016). Field data from the 2019 National High School/MA level UNBK results at the cell material amounted to 30.56% and at the Al-Islam Krian High School education unit level of 35.71, it was still far from the minimum absorption capacity of 55%. The results of student and teacher interviews through the instruments provided were 71.2% of students did not understand the cell material, and so far LKPD as one of the teaching materials used in MGPS-centered learning and publishers, so that access to students' creative thinking skills has not been implemented.

The results of previous research stated that student learning outcomes through the application of LKPD *mind mapping* on growth and development materials were 85% with an N-gain of 0.72, and flexible thinking creative thinking indicators (flexible thinking) of 82.5% (Setyawan, 2019). The use of *Mind mapping* through digital applications can help students visualize the structure and functional processes that occur in cells and connect between topics they learn in cell biology (Yeong, 2013). The effectiveness of genetics worksheets to train creative thinking skills using one group pre-post test design shows the development of students' creative thinking skills (Susanti et al., 2016). *Mind mapping* method in learning the human reproductive system in junior high school students, improves student learning outcomes and student responses are very helpful in remembering for understanding Latin languages and new concepts in the material (Dewi, 2019).

Based on the background of the problems that have been described then the general problem formulation in this research is: "How is the Feasibility of *Mind Mapping* Worksheet Based Learning Tools to Practice Creative Thinking Skills for Class XI MIPA on Cell Materials?", described through the following research questions; (1) How is the validity of the learning tools developed in terms of the presentation structure, material aspects, conformity with *mind mapping* and aspects of the scope of creative thinking skills?; (2) How is the practicality of the developed device in terms of its implementation through student activities during the learning process?; (3) How is the effectiveness of the device in terms of the results of creative thinking skills and student responses?.

RESEARCH METHOD
This research is development research using the 4D model. This research was carried out from Januari to Juni 2021. The development stage was carried out at the Postgraduate UNESA (Figure 1).
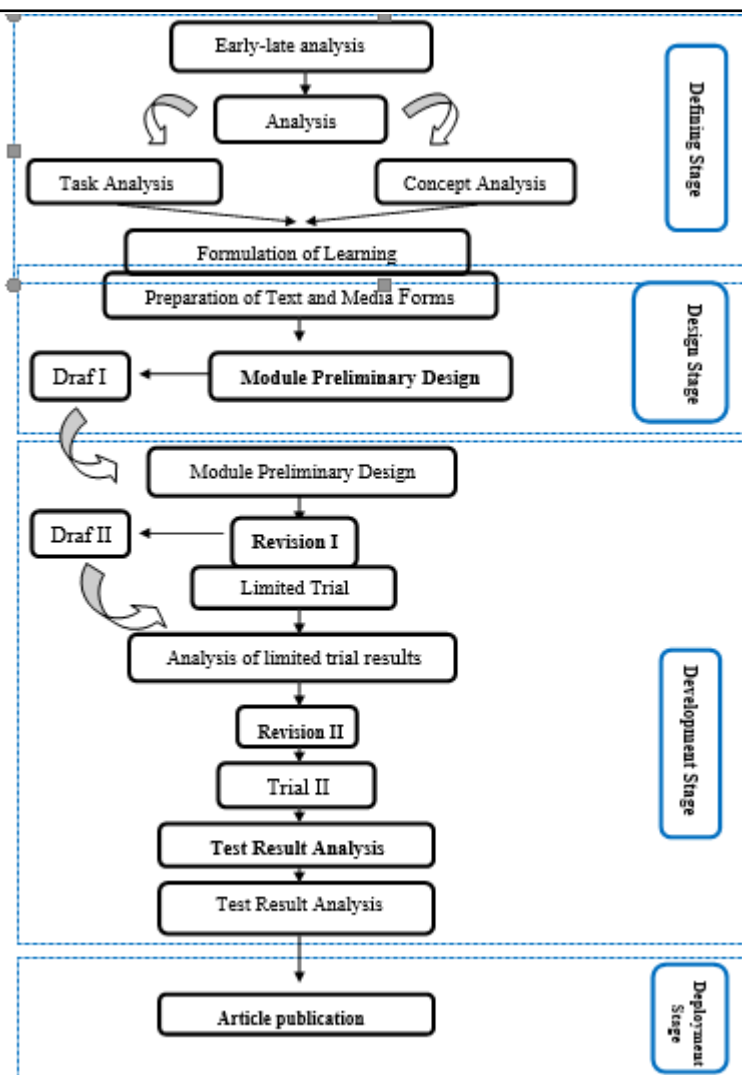
Figure 1. 4-D development model.

Sample / Participants / Group
The research subjects are learning tools, especially *mind mapping* worksheets to train students' creative thinking skills on cell material, the data sources for the trial are 23 students of class XI SMA Al-islam Krian Class XI Science for the academic year 2020/2021 with heterogeneous abilities

Instrument and Procedures
The research design used, namely the One Group Pretest-Posttest Design (Sugiono, 2018), is described as follows:

$$O_1 \longrightarrow X \longrightarrow O_2$$
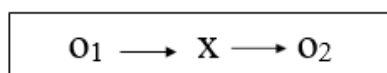
Information :
O1 : Pretest value before being given treatment
 X : Learning using *mind mapping* worksheet
O2 : Pretest value after being given treatment

The research instruments used in this study were (1) device validation sheets, (2) device implementation sheets, (3) creative thinking skills evaluation tests, and (4) student response questionnaires to *mind mapping* worksheets. The results of the data obtained in the form of a score from each aspect of the research that has been determined. Each aspect is assessed based on the Linkert scale with intervals of 1-4 as presented in Table 1

Table 1. Likert scale criteria.

Rating	Scale Value
1	Not good
2	Pretty good
3	Good
4	Very good

(Adapted from Riduwan, 2013)

Data Analysis
Validity analysis
Device validity data analysis techniques learning includes syllabus, lesson plans, LKPD mind mapping and creative thinking skills tests using qualitative descriptive. The resulting mode values are interpreted in Table 2 below

Table 2. Interpretation of validation analysis score.

Rating	Scale Value
1	Very Valid
2	Valid
3	Quite Valid
4	Less Valid

(Adapted from Riduwan, 2013)

Practical analysis
The analysis of the practicality of learning devices is the result of an observer's assessment of the activities of students in learning. The mode value of each observation component is interpreted in Table 3 below

Table 3. Interpretation of validation analysis score.

Rating	Scale Value
1	Less Practical
2	Practical enough
3	Practical
4	Very Practical

(Adapted from Riduwan, 2013)

Effectiveness analysis
Creative thinking skill scores were obtained based on the data from the students' pretest and posttest results, using the equation formula:

$$\text{Nilai Ketuntasan Individu} = \frac{\sum \text{skor yang diperoleh}}{\sum \text{skor maksimum}} \times 100$$

Completeness is said to be good based on indicators if it gets a percentage of ≥75%. The data is then analyzed to determine the improvement of student's initial abilities before and after learning. This increase is known through N-Gain analysis, then compared with categories by Hake (1999) namely normalized N-Gain, namely the comparison of the actual N-Gain score with the maximum N-Gain score. This can be expressed by the formula :

$$< g >= \frac{\% < Sf > - \% < Si >}{\% < S\ maks > - \% < Si >} x\ 100\%$$

Table 4. Normalized N-gain criteria.

Normalized N-Gain Range	N-Gain Criteria
g < 0,30	Low
0,30 ≤ g ≤ 0,7	Average
g > 0,70	High

(Hake, 1999)

The effect of applying *mind mapping* worksheet to train students' creative thinking skills and mastery of concepts is carried out by parametric statistical analysis using *SPSS 25.0 for windows*, taking into account some assumptions that population size testing through sample data that is, the data to be analyzed must be distributed normal and using data from two or more groups homogeneous (Sugiyono, 2014) as follows. Analysis of the effectiveness of the developed tools include:

a. Kolmogorov Smirnov normality test

The normality test aims to determine whether the residuals are normally distributed or not by using the Kolmogorov-Smirnov test at a significance level of = 0.05 (2-tailed). The basis for decision making is as follows;

If the value of Sig (2-tailed) > 0.05 then the data is normally distributed.

If the value of Sig (2-tailed) < 0.05, then the data is not normally distributed.

b. Levene homogeneity test

The homogeneity test aims to determine the test sample has the same variance, namely by using the Levene test at a significance level of = 0.05 (2-tailed). The basis for decision making is as follows:

If the value of Sig (2-tailed) > 0.05 then the data is homogeneous

If the value of Sig (2-tailed) < 0.05 then the data is not homogeneous.

c. Paired t-test

Paired t-test to find out whether there is a difference in the average of two paired samples (students' pretest results as data before treatment and students' posttest results as data after treatment). Paired t-test uses n-1 degrees of freedom, where n is the number of samples with a significance level of = 0.05 (2-tailed). The basis for decision making is as follows;

If the value of Sig (2-tailed) < 0.05, then there is a significant difference between learning outcomes in pretest and posttest data.

If the value of Sig (2-tailed) > 0.05, then there is no significant difference between learning outcomes in pretest and posttest data.

(Santoso, 2014)

RESULTS AND DISCUSSION

The developed *mind mapping* worksheet validation includes; (1) formative requirements include, among others, clarity and completeness of identity, suitability of LKPD, materials, models and learning objectives. (2) the didactic conditions in it contain the appropriateness of the content and the correctness of the language. (3) technical requirements. The level of validity (feasibility) of the LKPD mind mapping of the three validators is presented in Table 6 below;

Table 6. *Mind mapping* worksheet validation results.

No.	Aspects of assessment	Mind Mapping Worksheet												Category
		1			**2**			**3**			**4**			
		V1	V2	V3	V1	V2	V3	V1	V2	V3	V1	V2	V3	
Formative Conditions														
A	**Identity clarity and completeness**													
1.	Include name and education unit	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
2.	Include subjects	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
3.	Put the class name on the front cover	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
4.	Include time allocation/number of meetings	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
5.	Listing Core Competencies	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
6.	Listing Basic Competencies	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
7.	Effectiveness of time allocated to achieve goals	3	4	3	3	4	3	3	4	4	3	4	3	Valid
8.	Allocated time efficiency	3	4	3	3	4	3	4	4	3	3	4	3	Valid
9.	Clarity of Formulation of Indicators and Objectives with KD	3	4	4	3	4	4	4	4	4	3	4	4	Very Valid
10.	The elaboration of competency achievement indicators refers to basic competencies	3	4	4	3	4	4	4	4	4	3	4	4	Very Valid
11.	The elaboration of learning objectives refers to indicators of competency achievement	3	4	4	3	4	4	4	4	4	3	4	4	Very Valid
B.	**The suitability of worksheet, materials, models and learning objectives**													
12.	Conformity of worksheet presented with basic competencies	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
13.	The conformity of the worksheet presented with the indicators in the lesson planning plan	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
14.	The suitability of the worksheet presented with the learning	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid

No.	Aspects of assessment	*Mind Mapping* Worksheet												Category
	objectives													
15.	The suitability of the worksheet presented with the learning materials	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
16.	The suitability of learning materials with basic competencies	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
17.	Suitability of learning materials with indicators	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
18.	Suitability of learning materials with learning objectives	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
19.	The suitability of the learning material with the learning model	3	4	4	3	4	4	4	4	4	3	4	4	Very Valid
20.	The suitability of the learning model with the learning objectives	3	4	4	3	4	4	4	4	4	3	4	4	Very Valid
21.	The suitability of the learning model with learning activities	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
22.	Suitability of learning activities with basic competencies	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
23.	Conformity of learning activities with indicators	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
24.	Suitability of learning activities with learning objectives	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
Requirements disabled														
25.	The suitability of the learning process oriented to active learners	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
26.	There is a stimulus through reading, pictures presented or activities carried out by students	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
27.	Develop communication, social, emotional, moral and aesthetic skills as well as learning experiences	3	4	4	3	4	4	4	3	4	4	4	4	Very Valid
28.	Develop mind mapping skills	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
A.	**Content eligibility**													
29.	Content/material truth	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
30.	It is an essential material	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
31.	Grouped into logical sections	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
32.	Its role is to encourage students to think creatively (Fluency)	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
33	Its role is to encourage students to think creatively (Flexibility)	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
34.	Its role is to encourage students	4	4	4	4	4	4	4	4	4	4	4	4	Very

No.	Aspects of assessment	Mind Mapping Worksheet												Category
	to think creatively (Originality)													Valid
35.	Its role is to encourage students to think creatively (Elaboration)	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
B	**Language truth**													
36.	Grammatical correctness	3	3	3	3	3	3	3	3	3	3	3	3	Valid
37.	The suitability of the sentence with the level of thinking and reading ability as well as the age of the students	3	4	3	3	4	3	3	4	3	3	4	3	Valid
38.	Simplicity of sentence structure	3	3	3	3	3	3	3	3	3	3	3	3	Valid
39.	Sentences don't have double meanings	3	4	3	3	4	3	3	4	3	3	4	3	Valid
40.	Clarity of instructions and directions	3	4	3	3	4	3	3	4	3	3	4	3	Valid
41.	The language used is communicative	3	4	3	3	4	3	3	4	3	3	4	3	Valid
C	**Technical requirements**													
42.	The questions in the LKPD presented are no more than 10 words in one sentence	3	3	3	3	3	3	3	3	3	3	3	3	Valid
43.	The identity of the picture, table or as a stimulus is clear	3	4	4	3	4	4	3	4	4	3	4	4	Very Valid
44.	There is a difference between the questions and answers of LKPD users	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
45.	Clarity of instructions and directions	4	4	4	4	4	4	4	4	4	4	4	4	Very Valid
46.	The images or readings presented convey messages effectively to LKPD users	3	4	4	3	4	4	3	4	4	3	4	4	Very Valid
47.	There is a bibliography reference	3	4	4	3	4	4	3	4	4	3	4	4	Very Valid
48.	LKPD attracts users to carry out the activities contained in it	3	4	4	3	4	4	3	4	4	3	4	4	Very Valid
Worksheet Validation Component Mode														Very Valid

Description;
V1, V2, V3 = Validator

Based on Table 6 the results of the validity of the *mind mapping* worksheet based on formative, didactic and technical feasibility aspects have a mode score of 4 with a very valid category. The developed *mind mapping* worksheet fulfills the formative requirements, which includes completeness of identity, includes KI and KD, clarity of indicators and objectives, compatibility between worksheet, materials and lesson plans. To fulfill the didactic requirements, the worksheet developed includes, among others, a stimulus through reading, pictures presented or activities carried out by students,

developing active students, communication skills, social, emotional, moral and aesthetic, containing learning experiences in the form of mind mapping skills, contains the feasibility of the content, the truth of the content / material, contains questions that encourage students to think creatively. The use of correct, communicative, clear and meaningful grammar is not ambiguous and in accordance with the level of thinking of the age of the students.

The developed worksheet also meets the technical requirements, namely the writing of questions in the worksheet which is presented in no more than 10 words in one sentence, contains clarity of the identity of pictures, tables or as stimuli and instructions, there is a distinction between question and answer sentences, pictures or readings presented convey message effectively, there is a reference to the bibliography and attracts users to carry out the activities contained in it. The development of worksheet is in accordance with the provisions of the National Education Standards Agency (2006), that the LKDP is developed based on aspects of content feasibility, linguistic aspects, presentation aspects, and graphic aspects containing typographical indicators that facilitate reading comprehension and are attractive, appearance design, color composition, elements of clarifying functions and illustrations are able to clarify and facilitate understanding.

In addition to meeting the formative, didactic and technical requirements, the preparation of the worksheet is based on the study and deepening of cell material that is adjusted to the indicators of creative thinking skills. The four types of worksheet developed are as follows; (1) worksheet 1 contains an example of making a mind mapping of plant structures along with the steps for making a mind map, as well as training creative thinking skills to determine the main idea, main sub-ideas and keywords from cell readings (*fluency*) to prepare for mind mapping. (2) worksheet 2 trains creative thinking skills to analyze (*flexibility*), provide arguments (originality) from articles, case study readings and pictures of natural phenomena or cell problems. (3) worksheet 3 students are trained to think creatively in analyzing (*flexibility*) and giving conclusions (*fluency, flexibility and elaborating*) based on observations of diffusion and osmosis symptoms. (4) worksheet 4 students are trained to organize main ideas, main sub ideas, keywords in LKPD 1 and important words in answers to worksheet 2 and worksheet 3, to then arrange them in the form of a mind map of cells based on the steps to make a mind map. This is in line with the research of Susanti et al (2018), that students are given the opportunity to think creatively through mind mapping. connects branches and threads in all directions, unique in making color combinations and images and details in creating color combinations. Giving practice questions in the form of *mind mapping* worksheet as a stimulus, and response responses will train students to face problems and encourage students to respond to creative thinking quickly according to their learning experiences. This is in accordance with Ternodike's theory that, the more often a behavior is repeated and trained, the stronger the stimulus-response association will be. This activity is also correlated with Hergenhahn and Matthew (2008), Information processing theory, information in working memory needs to be organized, linked with other information and repeated to maintain it. *mind mapping* worksheet

contains open-ended questions based on thinking indicators (1) prior knowledge,
reading activities for cell material, determining main ideas, main sub-ideas and
keywords in *mind mapping* worksheet 1 reading (creative thinking skills; fluency) , (2)
short-term memory (short term memory), students' activities to answer the cell
problems that are stimulated in *mind mapping* worksheet 2 and 3 based on creative
thinking skills, flexibility and originality, (3) long-term memory, student activities make
mind mapping by recalling the learning experience there are *mind mapping* worksheet 1,
2 and 3. Students store as much information as possible, provide easy and direct access
to all the information they want, organize it and then arrange it into an original, unique
and unique cell mind map. different even for the same material. This is as stated by
Windura (2016) that the diversity of mind map results shows the mindset of each
student, the emission of thoughts resulting from thought associations that arise from a
center of mind.

Figure 2. Results of student cell mind map.

The pretest value shows the students' initial ability obtain individual mastery low,
then given treat *mind mapping* worksheet four times a meeting and then given a posttest.
Based on the average N-Gain value, the average posttest results are categorized as high,
it's just that there are some students who get he N-Gain value in the medium category.
The results of the recapitulation of the achievement of creative thinking skills on 10
questions of cell material presented in Table 7 below

Table 7. The results of the students' pretest and posttest.

Learners	Pretest	Postest	N-Gain Rate	Criteria
1	20	87,5	0,84	High
2	27,5	87,5	0,83	High
3	20	82,5	0,78	High
4	32,5	90	0,85	High
5	37,5	87,5	0,80	High
6	40	87,5	0,79	High
7	35	80	0,69	Medium
8	27,5	87,5	0,83	High
9	42,5	92,5	0,87	High
10	37,5	87,5	0,80	High
11	47,5	90	0,81	High
12	37,5	90	0,84	High
13	30	85	0,79	High
14	25	90	0,87	High
15	35	90	0,85	High
16	32,5	90	0,85	High
17	37,5	95	0,92	High
18	17,5	85	0,82	High
19	25	90	0,87	High
20	15	70	0,65	Medium
21	22,5	67,5	0,58	Medium
22	25	82,5	0,77	High
23	40	90	0,83	High

Based on Table 7 the results of the learning evaluation of the twenty-three learners experienced a very significant increase in value, with an N-gain ranging from 0.58 to 0.92 with a completeness of 86.3. During the learners learning process, completing the *mind mapping* worksheet containing openeded questions containing indicators of *fluency, flexibility, originality* and *elaborating*, making students trained to deal with problems and encouraging students to respond to creative thinking quickly according to their learning experience, so they are able to to solve problems with a similar technique when given an evaluation test. The activity of compiling a *mind mapping* through the steps of determining the main idea, determining the main sub-ideas, determining keywords to support the main idea, making branching as a link and providing details to clarify the reader as well as rewriting their understanding of the cell concept they are learning, make participants learn more about the concept. *Mind mapping* activities both individually and in groups require students to be able to understand and remember the material they read, then express it in writing (Muslimin, 2019). The use of mind map media will make it easier for students to understand topics with high conceptual complexity (Dewi, 2019). Some learners still have a medium in practicing *mind mapping* worksheet during learning have not shown creative thinking skills, and the results of the *mind map* cells made are not in accordance with the correct instructions. This is due to several factors, among others; differences in developmental

patterns that are not the same in both ways of thinking and behaving in solving problems. The social and emotional development of students is a unique and permanent difference that is influenced by heredity and the environment (Surna and Olga, 2014). The incompleteness of students is also due to the factor of creative thinking skills which are high-level cognitive scales including C4, C5 and C6, as the results of research by Susantini et al (2016), states that creative training must include evaluation instruments that involves higher levels of thinking, including creative thinking skills. Based on the results of interviews with teachers and learners in the pre-research, so far in the pilot school they have never trained creative thinking questions and made mind mapping in learning, so some students need more time to explore their creative thinking skills. Figure 3 below presents the achievement of creative thinking indicator skills;
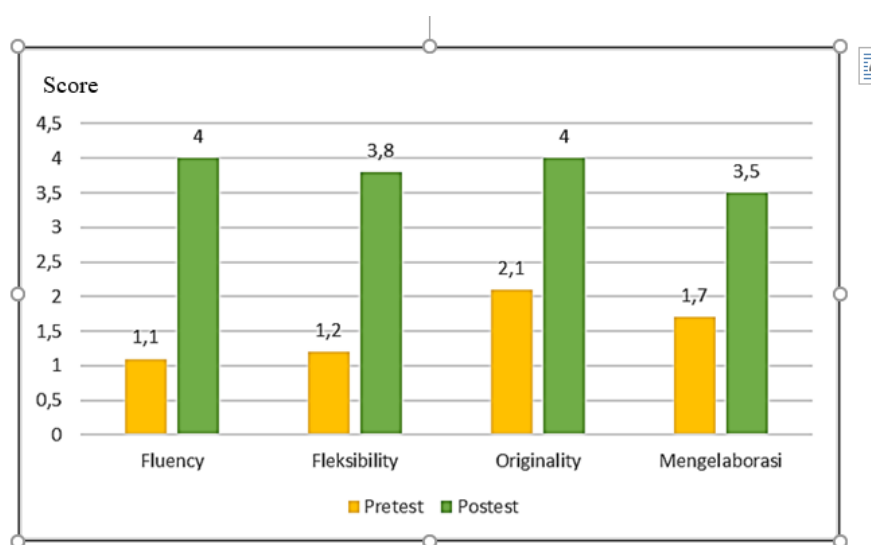

Figure 3. Graph of learners' creative thinking skills during the trial.

The *fluency* indicator has an N-gain of 0.86 in the high category, it can be seen in how the participants interpret the relationship between the characteristics of the cell membrane constituents and the permeability properties (question no. 2) and are able to describe the organelles that play a role in protein synthesis (question no. 6) from reading articles which is simulated in the problem. *Fluent* thinking behavior is being able to answer several answers if there are questions, asking many questions, expressing opinions to express many ideas / ideas related to a problem, and working harder. The indicator of *flexibility* with N-gain in this aspect looks 0.92, it can be seen in the students' skills in making hypotheses about organisms that have the highest adaptation based on the presence or absence of membrane structures (question no. 1), concluding cell organelles that play a role in overcoming the toxic effects of H_2O_2 (question no. 3), hypothesized the dysfunction of cell organelles causing Pompe's disease (question no. 4), and hypothesized the number of mitochondria based on differences in the activity of several body muscle cells (question no. 8). This is because students through the learning experience using mind mapping worksheet train their ability to analyze and solve problems. Open-ended questions with (*divergent*) thinking will give a person the opportunity to give more than one and different correct answers

so as to encourage *flexible* thinking (Buzan, 2018). *Originality* indicator, seen in students' skills in comparing the types of cytoskeleton constituents (question no. 7) and providing an argument against a case study if plants were given excessive amounts of fertilizer (question no. 10), has an N-Gain with a range of 0.83 high category. Mind *mapping* worksheets contain open-ended questions to train students to give many answers (fluency) and analyze pictures/stories in solving cell problems that are simulated in *mind mapping* worksheets (*flexibility*) which indirectly stimulate students to develop *originality* creative thinking skills. Students' skills can be seen in how they practice interpreting arguments against a problem, analyzing an object or story related to cells, analyzing the results of the diffusion and osmosis symptoms practicum and making conclusions so that indirectly the three aspects complement each other. This is in accordance with Arulselvi's report (2017), which states that originality will emerge if the teacher develops fluency and flexibility through question and answer activities or discussions. *Elaborating* skills, having an N-gain of 0.86, shows the students' skills to compare the types of cytoskeleton constituents (question no. 7) and detail the dissolution process (question no. 9). *Mind mapping* worksheet 4 trains students to make cell *mind maps*, in this activity students train their cognitive development to interpret their understanding of the cell concept, visualize and communicate it through detailed images so that it can be understood. This is in line with research of Widiana and Jampel (2016) that, the teaching process through providing opportunities for students to present their abilities based on the material studied then followed by a review of the concepts studied will strengthen the concepts they have constructed themselves from the first stage.

The results of the parametric statistical tests of normality, homogeneity and the effect of the application of mind mapping worksheets in learning based on the results of the pretest and posttest are presented in Table 8 below

Table 8. Pretest and posttest parametric statistical test result.

Test	A	Sig	Description
Normalitas	0,05	0,2	Normal
Hemogenitas	0,05	0,032	Homogen
Paired t-test	0,05	0	There is a significant difference

Based on the results of the Kolmogorov Smirnov test, it was obtained that sig > , meaning that the data came from a normally distributed population. This means that the state of the sample taken is similar to the actual population. Based on the results of Levene's test, it is obtained that sig > , meaning that the data comes from a homogeneous population variance. Based on the test results, it shows that all students have the same knowledge ability at the beginning of learning. Based on the results of paired t-test, it is obtained that sig < , means that the average pretest and posttest results are significant difference (Sugiyono, 2014).

Student Worksheets (LKS) as part of teaching resources can foster students to generate their own thoughts, ask questions, make connections, evaluate results, so that student autonomy increases as well (Chappell and Craft in Susantini et al (2016)) The application of mind mapping can stimulate students' imagination to facilitate them in

expressing the concepts/ideas in their minds and the production of mind mapping
proves that students understand the interconnection of the concepts studied (Widiana
and Jampel, 2016).

CONCLUSION
The development of a mind mapping worksheet-based device was declared feasible
(valid, practical, and effective) to train students' creative thinking skills in class XI
MIPA on cell material. Based on the results of the limited trial conducted, it is necessary
to provide an explanation of mind mapping before the mind mapping worksheet is
applied in learning with an appropriate time allocation. Learning that has enough
material should use mind mapping to summarize and strengthen memory and make it
easier for students to understand the material being studied.

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