J.Biol.Educ. 8 (2) (2019)

Journal of Biology Education

http://journal.unnes.ac.id/sju/index.php/ujbe

The Development of Respiratory System Teaching Material Supplement as a Health Awareness to the Dangers of E-Cigarettes

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Article Info

History Article:
Received : June 2019
Accepted : August 2019
Published : August 2019

Keywords:
care, e-cigarette, respiration system, teaching material supplement

Abstract

Based on KD (Basic Competence) 3.8 and 4.8 of class XI curriculum 2013 in respiration system material, in learning must be started from relevant facts often faced by students, one of which is in the subject of respiratory system disorders. Along with the development of age, respiratory system disorders caused by exposure to cigarettes are a problem that often occurs in adolescents. So, it is necessary to supplement teaching materials that support the primary teaching materials to achieve these learning goals. The purpose of this study is to analyze the feasibility and effectiveness of supplementary respiratory system teaching materials developed. The research uses the Research and Development (R&D) method based on ten steps of R & D research in Sugiyono (2015). The test and indicators for determining the feasibility and effectiveness of supplementary teaching materials are (1) feasibility tests include the study test and readability test each ≥ 51%, (2) test the effectiveness in improving learning outcomes with classical completeness test ≥ 70% of students who achieved a value of ≥ 70, medium to high N-gain test, and sensitivity index items ≥ 0.30, (3) effectiveness test in growing students' caring attitudes students with the percentage scale score of caring attitude ≥ 51%. The results show that the feasibility test is obtained by a 100% review test in very valid and 100% readability test in very good, the effectiveness test for improving learning outcomes showed 87.5% of classical completeness results, N-gain score 0.7 (high), item sensitivity index questions 0.4 (sensitive), the effectiveness test in growing caring attitude shows overall on the caring criteria (there are 2 students or 6.25%) and very caring (there are 30 students or 93.75%). The conclusions in this study are respiration system supplementary material as supplementary teaching material is appropriate and effective in improving learning outcomes and also effectively fostering caring attitudes of students towards the dangers of e-cigarettes for health.

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p-ISSN 2252-6579
e-ISSN 2540-833X

INTRODUCTION

2013 Curriculum requires a change of attitude through learning activities carried out. The implementation of biology learning in the 2013 curriculum expects active and characterized students. The attitude dimension in the 2013 Curriculum is divided into aspects of spiritual attitudes and social attitudes. Social beliefs are manifested through caring. Care as a positive attitude to respect and respect as an effort to grow conservation education. One crucial caring attitude is social care. According to Hardati *et al.* (2016), social care is an attitude that always assists other people and people in need. Social caring attitude will lead to interaction or communication with other people. Cognitive understanding of students about the problems that occur and the quality of learning also affects the caring attitude of students (Taufiq *et al.,* 2014).

One of the learning resources that is used by teachers is teaching materials. Teaching materials are fitted to the needs and daily experiences of students in addition to being able to increase students' understanding and also influence the attitudes of students. According to Leksono *et al.* (2015), conservation biology teaching materials can increase students' awareness of the environment, including in the social environment that is prepared based on the daily lives of students. Development of teaching materials can be done if there are problems that are not available in the primary teaching material so that supplements are needed to support the learning.

In KD (Basic Competence) 3.8 and 4.8 class XI Curriculum 2013 especially the material of the respiratory system must begin with relevant facts that are often faced by students. These facts can be in the form of problems that occur in everyday life that can be presented in supplement teacher teaching materials to support the main teaching material. Teaching material supplements are designed attractively that pay attention to material aspects, language, presentation, and graphics so that it is attractive to users, especially students. Problems about smoking, both tobacco cigarettes, and e-cigarettes, are the main problems in adolescents. Respiratory system disorders due to exposure to cigarettes can endanger the lungs with increased leukocytes as the body's defense is characterized by an increase in the number of alveolar macrophages (Lisdiana *et al.,* 2017). Based on the National Youth Tobacco Survey (NYTS), a nationally representative cross-sectional survey of teenagers from the United States from 2011-2014, showed that the highest vape consumption was high school age.

The results of the observation through interviews with 15 people, 10 of them show the fact that many smokers were found as teenagers with the status of students who are still in high school or equivalent started smoking from junior high school. According to Infondation (2013), almost 80% of smokers start smoking when they have not reached 19 years. According to them, smoking is a natural thing that gives the effect of calmness. Some of them besides consuming tobacco cigarettes also consume electric cigarettes, even though they are equally dangerous.

Based on the results of the interview with the biology teacher of class XI MIPA, SMA Negeri 2 Rembang, the learning have been carried out optimally by utilizing the available facilities, one of them is the teaching material used. Teaching materials have varied both in the form of books from publishers and made by teachers. However, the teaching materials still lack, such as a less attractive design, simple design, the presentation of material has not met the needs of the age, especially in the submersion of respiratory system disorders in humans that are increasingly complex, especially those caused by exposure to cigarettes both tobacco cigarettes and e-cigarettes. Students already know the dangers of e-cigarettes for health, but their concern about these dangers has not grown well, so we need supplementary teaching materials that

contain the dangers of exposure to e-cigarettes for health by design and presentation according to needs, which are expected to increase students' interest in reading. giving awareness to the attitude of the social care of students. The teacher mentioned that students' reading interest is still low, which affected learning outcomes as evidenced by the percentage of achievement of the KKM (Minimum Completeness Criteria) that is only 60% of students who reached the KKM in respiration system material.

The results of the questionnaire analysis of students with samples of class XI MIPA 1 and MIPA 2 can be known as 79% mentioning that the respiration system material is challenging to understand, especially in the respiratory system disruption. Furthermore, it requires facts that can provide understanding for students presented through supplementary teaching materials, one of the facts about the dangers of e-cigarettes for health.

Based on this background, it is necessary to conduct research on "The Development of Respiratory System Teaching Material Supplement as a Health Awareness to the Dangers of E-Cigarettes."

RESEARCH METHOD

This research is a type of development research with research and development methods based on ten research steps in Sugiyono (2015) which produce a product in the form of a supplementary respiration system teaching material. This research is conducted at the Biology Department of Semarang State University for product development and in SMA Negeri 2 Rembang for product testing. This research is conducted from December 2018 to May 2019.

The analysis of the needs of developing supplemental teaching materials is known through interviews with teenagers, interviews with biology teachers, and the distribution of the analysis of the needs of class XI students' questionnaire. Product trials are conducted to determine the feasibility and effectiveness of the product. Feasibility test through product validation by material experts and media experts (review tests) and small-scale trials with data in the form of student responses and teacher responses (readability test). Material experts and media experts are lecturers who are experts in their fields. The responses of students are taken from 10 students who have received respiration system material learning. The teacher's responses are made from two biology teachers in class XI. The effectiveness test is obtained at the large-scale trial stage through experiments. The experimental design used a one-group pretest and posttest design by giving treatment to one class for sampling.

The independent variable on this effectiveness test is supplementary respiration system teaching materials, while the dependent variable is the learning outcomes and caring attitudes of students. The study population included all students of class XI, while the sample used the XI MIPA 1 class taken by purposive sampling technique. Data on learning outcomes through pretest and posttest include classical completeness, N-gain test, sensitivity test items using the item Criterion Reference Test. While caring attitude data in the form of percentage scores obtained through the psychological scale of students' caring attitude.

RESULTS AND DISCUSSION

This study took data from the results of development and implementation in the form of supplements for respiration system teaching materials. The development phase obtains data

by conducting interviews and giving questionnaires on needs analysis. The implementation phase obtains data in the form of feasibility and effectiveness of supplementary teaching materials. The results of the research obtained are presented as follows.

Feasibility of Respiration System Teaching Materials Supplements

Feasibility of respiration system teaching materials supplementation is the result of research from a review and readability test with each score reaching ≥ 51%. The study test is obtained from the average data on material validity and media validity, while the readability data was from the average responses of teachers and students.

The component validity of supplementary teaching materials consists of material feasibility, language as a component of material validity, and component presentation and graphics as components of media validity. Validation is carried out by material experts and relevant media. The results of the validity of supplementary materials for teaching materials by material experts can be seen in Table 1 which shows a percentage score of 93% with criteria very valid and without revisions so that they can be used for research. This is because the material presented in supplementary teaching materials has been adjusted to the 2013 curriculum based on Core Competencies (KI) and Basic Competencies (KD) contained in the learning syllabus. The assessment component used is material and linguistic feasibility.

Table 1 The result of material validity of respiration system teaching material suplementary

No	Reviewed Aspects	Score
	MATERIAL FEASIBILITY	
A.	Material completeness	8
B.	Material accuracy	7
C.	Material update	8
D.	Material can improve students' biological competency	4
E.	Material follows systematically sciences	6
F.	Material develops thinking skills and abilities	15
G.	Stimulating curiosity	8
H.	Stimulate interest	4
Total score of material feasibility		**60**
	LANGUAGE	
A.	Compatibility with the right Indonesian grammar	7
B.	Communicative	11
C.	Coherence and systematically of mindset	7
D.	The term and symbol use	8
Total score of language aspects		**33**
Total score		**93**
Total maximum score		**100**
Score Percentage (%)		**93**
Criteria		**Very Valid**

In the material feasibility aspects of developed respiration system teaching materials supplementary, the material presented is in accordance with the applicable KI and KD. The material has the accuracy of facts that are adjusted to the facts of cases that occur in the community. The facts source from news, institutions, journals, which are relevant and the results of research conducted by researchers presented in section 3 of developed teaching materials supplementary. The presented material applies biological concepts with technology and life as time goes on. One of the crucial demands of the age on the respiratory system is about the dangers of cigarette exposure to health both tobacco cigarettes and e-cigarettes. The material presented is able to foster the enthusiasm and caring attitude of students because the

material is adapted to the problems that occur in everyday life at the age of adolescents so that students have a high curiosity, as well as the addition of motivational sentences of the dangers of e-cigarettes for health presented in the upper right corner also has an influence on students. This is in line with the research of Purwanto & Swaditya (2015), the material that is associated with the conditions of problems in the student environment can make learning more meaningful and encourage students to make connections between the knowledge they have and the application in everyday life.

This teaching material supplement is equipped with cases that occur in everyday life so that students are expected to be interested and motivated to solve the cases as evaluations to find out understanding of learning. This is in line with the research of Amir *et al.* (2016), states that good teaching materials are equipped with evaluations relating to the results of videos obtained by students so that learning can occur well because students are interested and motivated.

The linguistic aspects of teaching materials supplementary use language that is in accordance with good and correct Indonesian language rules, communicative, clear learning goals, consistency in the use of terms and symbols, and the existence of additional information such as the link column also helps stimulate students to open the link to increase their knowledge. According to Thamrin (2014), the component of linguistic feasibility in teaching materials must meet several aspects; they are the accuracy of sentence structure, the effectiveness of sentences, encourage critical thinking, the suitability of the intellectual level of students, the accuracy of grammar and spelling and the consistent use of terms and symbols.

Based on media validity by media experts obtain a percentage score of 97% which shows the criteria very valid, this is because supplementary teaching materials are prepared based on the criteria of textbooks according to the BSNP (Board of National Education Standard). There are two components to media validity, namely the components of presentation and components of graphics. The results of media validity can be seen in Table 2:

Table 2 Results of Validity by the Media on Supplementary Respiratory System Teaching Materials

No	Assessed Aspects	Score
	PRESENTATION	
A.	Systematic consistency in the presentation of supplementary teaching materials	12
B.	Material presentation supporter	27
Total score of presentation aspects		**39**
	GRAPHIC	
A.	Size of teaching materials	8
B.	Cover of teaching materials supplement	23
C.	Content design	27
Total of scores for graphic aspects		**58**
Total score		**97**
Maximum total score		**100**
Score Percentage score (%)		**97**
Criteria		**Very Valid**

The presentation aspect using presentation techniques that already has systematic consistency in the presentation. The presentation is complete, and there is the relevance of the concept. The teaching materials supplementary are also supported by illustrations, images, texts, tables, numbering, introductions, glossaries, and bibliography that has obtained

maximum scores. According to Suswina (2011), the presentation aspects of teaching materials must have interrelationship that is explained carefully. The topic is presented systematically with relevant presentation strategies, the chaotic content of instructional materials makes it easier for students to learn and describes a discussion needed examples and illustrations that can help and facilitate students.

The general aspects of graphics get maximum results including the size of teaching materials, cover supplements of interesting teaching materials can be seen from color, harmonious layout, use of letters, illustrations, and clarity to evenness of prints, while there are still shortcomings in the cover illustration because using images not from the results of the documentation itself, besides that there is still a page that has too long lines of sentence so that repairs are made to some of these aspects according to the validator's suggestion. According to Korniawati *et al.* (2016), the developed handouts are considered to have the choice of colors that are attractive, harmonious, and do not interfere with concentration, and use easily readable types and fonts so that they are valid and easy to use.

There are suggestions and improvements based on the advice of media experts. They are the sentence "Concept Map" is replaced with "Material Map", not take all illustrations or images from the internet, there are very long lines of reading texts that look monotonous, stiff, boring, there are images that have no information that can reduce understanding for the reader. The four components of validity can be seen in Figure 1.

Based on the results of material validity and media (review test) obtained an percentage of 100% validity in the criteria "very valid". In the next stage, the readability test is obtained from the average data of student and teacher responses on a small scale test. The results of the questionnaire responses of students showed an percentage yield of 100% in the criteria of very good to teaching materials supplement. The results of student responses can be seen in Table 3.

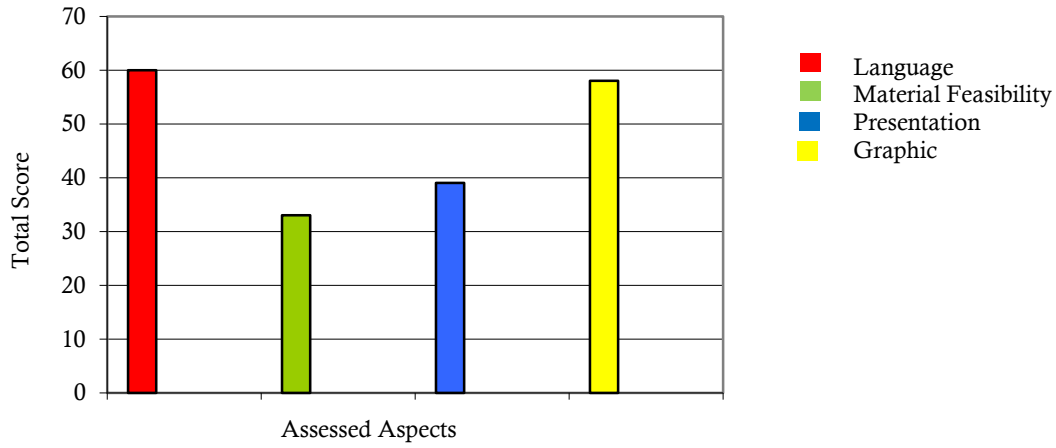

Figure 1 Graphic of Recapitulation Result of Media and Material Component Validity

Students are very interested in supplementing teaching materials developed, this can be seen the enthusiasm of students when the researchers first gave supplementary books for teaching materials to be given a response. According to students the combination of color and supplement design of teaching materials is very appropriate, good, the images and illustrations are precise and correction, the material presented also supports the material in the main teaching material used by the teacher, especially in the third section which discusses the dangers of e-cigarettes especially with the presentation through cases or cigarette problems that often

occur in everyday life. The words in the upper right corner of the supplementary book on teaching materials about the concern of the dangers of e-cigarettes can influence students' motivation. According to Darmayanti *et al.* (2014), books of students with examples, illustrations, and the selection of the right colors and the selection of simple languages can attract the attention of students to read it and reduce saturation.

Table 3 Result of percentage of student responses

No	Student's Code	Percentage of Students' Responses (%)	Criteria
1.	UK- 01	96	Very good
2.	UK- 02	90	Very good
3.	UK- 03	92	Very good
4.	UK- 04	86	Very good
5.	UK- 05	92	Very good
6.	UK- 06	98	Very good
7.	UK- 07	88	Very good
8.	UK- 08	96	Very good
9.	UK- 09	90	Very good
10.	UK- 10	90	Very good

The percentage of student responses by 100% is in the criteria of very good, although there are still improvements based on suggestions from students. According to Nurhidayah *et al.* (2014), the development of supplementary teaching materials after small-scale testing still requires revision or improvement before being tested on use, the revision aims to improve the wrong or incorrect parts to produce better learning resources.The results of the teacher responses questionnaire obtained from two biology teachers at SMA Negeri 2 Rembang showed a very good response, the percentage score of each was 96% and 92% with an average of 94% which showed the criteria of very good. The results of the teacher's responses are seen in Table 4.

Table 4 Result of percentage of teacher responses to supplementary teaching materials

No	Biology Teachers' Code	Percentage of Teacher Responses (%)	Criteria
1.	UG- 01	96	Very good
2.	UG- 02	92	Very good

In general, the teacher believes that the supplement is very suitable for the needs of students, especially in the third section of the material, namely about the dangers of e-cigarettes for health because the main teaching materials have not yet been explicitly discussed. The teacher admits that he often gets questions from students regarding differences in the dangers of e-cigarettes and tobacco cigarettes, but teachers are often still hesitant in giving answers because they have not found the right source. In supplementing this teaching material, it can be used as a source to answer this question because the third sub-chapter material comes from the results of research on the dangers of e-cigarettes for health which is characterized by an increase in alveolar macrophages. Teaching materials with material arranged systematically, language easy to understand, and learning objectives formulated clearly will help teachers in teaching and add new experiences for students in receiving material (Assalma *et al.,* 2013).

The feasibility of respiration system teaching materials supplement based on the results of a media validity 97% very valid, material validity 93% very valid, teacher responses 100%

very good, students responses test is obtained 100% very goodrespectively. It shows the respiratory system teaching material supplement is appropriate to be implemented in the respiratory system learning process in SMA.

The Effectiveness of Respiratory System Teaching Material Supplement

Indicators of the effectiveness of developed respiratory system teaching material supplement are student learning outcomes and students' social care attitudes. Implementation of respiratory system teaching material supplement based on the developed RPP (Lesson Plan) by the teacher in accordance with the syllabus refers to the KI and KD 2013 curriculum in class XI MIPA. Learning outcomes are abilities possessed by students after going through the teaching and learning process (Sudjana, 2005). Data on cognitive learning outcomes of students were obtained from the pretest and posttest in the form of multiple-choice tests. The multiple-choice test is the most desirable test because it is easily assessed, easy to do, and can be used as a basis for analyzing learners' understanding of learning (Simkim *et al*., 2005).

Implementing supplementary teaching materials in learning uses a problem-based learning (PBL) learning model with three meetings. Students are very active and enthusiastic in learning, especially in solving the problems given by the teacher. According to Ristiasari *et al*. (2012), PBL learning according to students is active in solving problems so as to be able to help students in achieving good learning outcomes compared to students who are given lecture learning models and discussion only. The indicators of effectiveness on student learning outcomes are obtained from the pretest and posttest to determine the classical completeness, N-gain, and sensitivity of the items to learning. The percentage of each indicator is presented in Tables 5, 6, 7 and 8:

Table 5 Classical completeness of students in class XI MIPA 1

Information	Total
Completed students	28
Incomplete students	4
Classical Completeness (%)	**87,5**

Percentage of classical completeness in class XI MIPA 1 after learning using respiration system teaching material supplement is equal to 87.5% of students who reach ≥ 70 (KKM = 70) with a total number of students in that class as many as 32 children. This shows an increase in the classical completeness of the pretest because at the time of the pretest no one reached a value of ≥ 70 so that classical completeness is 0%, as well as the results of interviews with biology teachers that classical completeness in respiration system material usually only reached 60%from students who reach ≥ 70. This is in line with Yusriya *et al.* (2014), class learning outcomes show good completeness which is > 85% of students achieve classical completeness.

Classical completeness in this study does not reach 100% because there are several factors that influenced the achievement, one of which was the lack of students' understanding of the material due to the absence of students in the meeting. A total of 4 students who do not reach the KKM are due to their absence. There are those who do not present at the second meeting of the three meetings that are conducted in the learning material of the respiratory system and they do not ask their friends about the meeting. According to Wadesango & Saverino (2011), the absence of students interferes with the learning system and has a negative

effect on classroom conditions and on the student's learning outcomes, students who attend more regularly and take lessons will get better results.

The next indicator of effectiveness is comparing the pretest score with posttest whether or not there is an increase in students' knowledge. The table of increase in pretest and posttest results in students is presented in Table 6:

Table 6 Improved pretest and posttest results for students

Information	Score	
	Pretest	Posttest
Lowest Score	6	16
Highest Score	15	23
Average	9,1	19,6

There is improvement on pretest and protest that is obtained by students which is analyzed using N-Gain test. The N-gain test result is presented on Table 7:

Table 7 Recapitulation of N-gain Test

Information	Result
Pretest	9,1
Posttest	19,6
N-gain	**0,7**
Criteria	**High**

Based on Table 7, on the effectiveness test of teaching material supplement in learning shows that the analysis of N-gain test in class XI MIPA 1 is 0.7 with "high" increasing criteria. The increase in the results of the pretest and posttest in each student is presented in Figure 2.

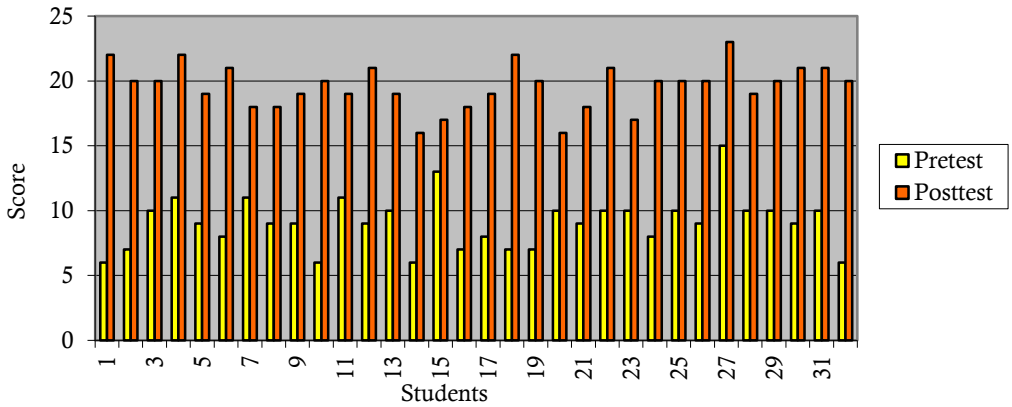

Figure 2 Improvement of the results of the pretest and posttest in each student

The next indicator of the effectiveness of learning outcomes is the sensitivity of the items on the cognitive aspects tested using the criterion reference test item which states the sensitivity of the items to the learning process. The results of the criterion reference test item analysis are presented in Table 8. Based on Table 8 shows that all items used in the pretest and posttest had the sensitivity to learning. According to Sudiarman *et al.* (2015), in the sensitivity test of the items showing all the questions totaling 30 items in the knowledge competency had

sensitivity above 0.3 with an average sensitivity of 0.5 indicating the whole question of sensitivity so that the items, in general, are stated to be sensitive to the learning process.

Table 8 Results of item sensitivity analysis about pretest-posttest

Item Number	Pretest (Rb)	Posttest (Ra)	Sensitivity Indeks (S)	Category
1	19	32	0,4	Sensitive
2	11	23	0,4	Sensitive
3	5	32	0,8	Sensitive
4	18	32	0,4	Sensitive
5	23	32	0,3	Sensitive
6	12	27	0,5	Sensitive
7	4	27	0,7	Sensitive
8	19	28	0,3	Sensitive
9	20	28	0,3	Sensitive
10	13	23	0,3	Sensitive
11	4	22	0,6	Sensitive
12	10	23	0,4	Sensitive
13	6	18	0,4	Sensitive
14	16	25	0,3	Sensitive
15	6	20	0,4	Sensitive
16	3	17	0,4	Sensitive
17	9	29	0,6	Sensitive
18	13	22	0,3	Sensitive
19	6	22	0,5	Sensitive
20	9	18	0,3	Sensitive
21	18	26	0,3	Sensitive
22	9	22	0,4	Sensitive
23	7	20	0,4	Sensitive
24	14	28	0,4	Sensitive
25	16	30	0,4	Sensitive
Average			**0,4**	**Sensitive**

Based on the overall analysis of learning outcomes in learning using respiratory system teaching material supplement give 87.5% classical completeness results, N-gain 0.7 (high), sensitivity index items about 0.4 (sensitive) which showed that supplementary teaching materials respiration system effective for improving learning outcomes. According to Mustofa *et al.* (2013), the results of developing LKS learning resources are worthy of being used as science teaching materials and can improve student learning outcomes.

According to Aritonang (2008), the factors that influence learning outcomes include the low interest and learning motivation of students, as well as the state of the social environment. According to Anni (2007), learning outcomes are influenced by internal and external factors. Internal factors can influence the process and learning outcomes including physical conditions (the health of body organs), psychological conditions (emotional intellectual abilities), and social conditions (ability to socialize with the environment). External factors influence student learning outcomes, one of which is the application of learning models. When viewed from the indicators of classical completeness and N-gain value, the effectiveness of supplementary teaching materials is maximal, but when viewed from the results of the item

sensitivity index the results obtained are not maximal. This can be influenced by several factors including the selection of learning models, analysis of the characteristics of students, and the composition of the material on the questions.

The effectiveness of developed teaching material supplement to foster a caring attitude is obtained by filling in the psychological attitude scale given at the last meeting in the respiratory system chapter. The recapitulation of the results of the analysis of students' caring attitudes is presented in Figure 3. Based on Figure 3, it can be seen that the overall score percentage of students in the caring criteria is 6.25%, while the criterion is very concernedabout 93.75%.

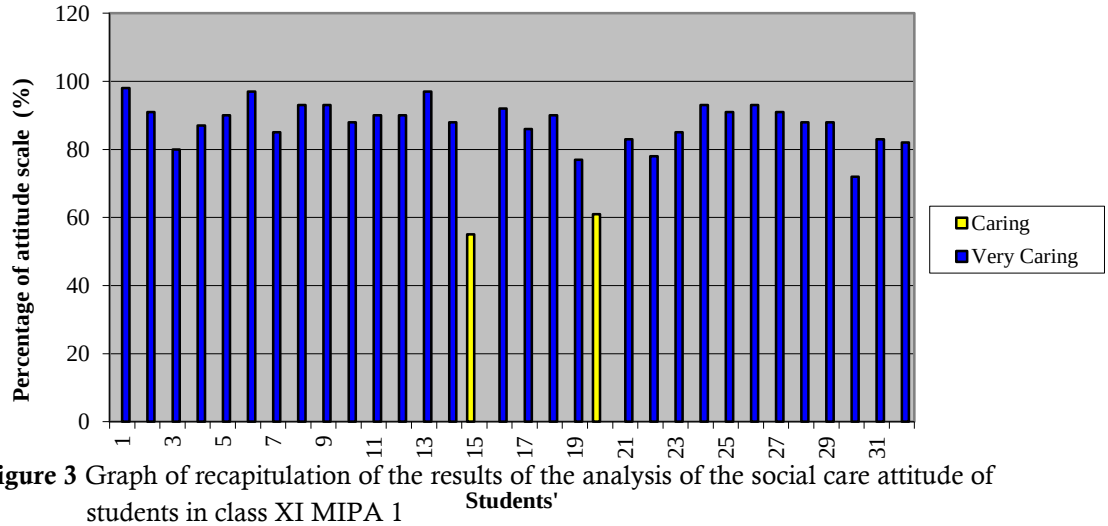

Figure 3 Graph of recapitulation of the results of the analysis of the social care attitude of students in class XI MIPA 1

Improvement knowledge of students about the respiratory system, especially in the dangers of e-cigarettes for health, is followed by the growth of caring attitudes of students. Most of the students who completed the KKM in the posttest with moderate and high N-gain test had an attitude scale indicating the criteria of very caring. While there are four students who do not complete the KKM in code A-14, A-15, A-20, and A-23 there are those who have very caring criteria but there are also those who have the criteria of caring. It can be seen that after supplement use teaching materials can improve students' understanding and foster a caring attitude for students. According to Taufiq *et al.* (2014), cognitive understanding of students about the environment affects the attitude of caring for the environment. In the participant A-15 code, after an approach through interviewing how he thought about the learning that had been done using teaching material supplement. He argues that learning is interesting but he still has an understanding that smoking is a harmless activity so he is not very interested in the discussion of cigarettes. Then the researcher asks other students about the A-15 student, it turns out that student with the A-15 code, is one of the students who smoke or became active smokers despite smoking outside the school environment. According to Siagian (2012), students' pleasure and interest in learning positively correlates with learning outcomes.

The learning process can affect the attitude of students, for example, the learning model used. The learning model in this study is PBL. In the learning process, it can be seen that PBL can influence caring attitudes. It is seen from the way students solve problems taught in respiration system material, especially about the dangers of cigarettes for health. With these problems presented, participants students will find the right solution by adding concepts,

understanding, and knowledge of students to the dangers of cigarettes so that they can foster a caring attitude of students towards the dangers of e-cigarettes for health. According to Husna (2013), the application of the PBL model can improve students' caring attitude after learning the concept of environmental destruction and pollution through PBL models because at each step PBL can foster students' curiosity about the environment and surroundings, and students feel not only learning theory but they act as a researcher for solutions to problems that occur around.

CONCLUSION

Based on the results of the research, data analysis, and discussion, it can be concluded that the respiration system teaching material supplement is appropriate and effective to be used in respiration system material learning.

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