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THE DEVELOPMENT OF ANTI MISSOLI SOFTWARE TO REDUCE MISCONCEPTION USING CONCEPTUAL CHANGE TEXT STRATEGY IN SOLUBILITY EQUILIBRIA

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Abstract
This study aimed to determine the feasibility of Anti Missoli software to reduce misconception using conceptual change text strategy in solubility equilibria. The software feasibility is assessed based of three aspects, i.e (1) content validity and construct validity, (2) practicality based on student response questionnaire and supported by student activity observation, (3) effectiveness based on shifting understanding of student conceptions from misconception to knowing concept. The method of the research used Research and Development (R&D) method with 12 students of class XII science in MAN 1 Gresik which selected based on the preresearch results conducted by researchers. This study was conducted in January 2019. The result showed that Anti Missoli software was used to reduce misconception using conceptual change text strategy in solubility equilibria based of three aspects, i.e (1) The average percentage of content validity is 83.33% - 91.67% with very valid criteria and construct validity is 88.89% - 93.06% in very valid criteria, (2) The average percentage of student positive response is 83.33% - 95.84% in very practical criteria and supported by student activities is 83.33% – 100% in very practical criteria, (3) The average percentage of shifting understanding of student conceptions from misconception to know concept is 86.07% in very effective criteria.
Keywords: Software, Misconception, Conceptual Change Text, Solubility Equilibria.

INTRODUCTION

Now, the development of science and technology has experienced rapid development. It needs the high-quality and high-potential human resources by improving the quality of education. The government efforts to improve the quality of education in Indonesia by development and implementation of the curriculum 2013. According to Permendikbud Number 22 of 2016 about standard process of primary and secondary education stated that one of the principle of curriculum 2013 is using information and communication technology to improve the efficiency and effectiveness of learning [1]. The using of it is expected to make students understand a matter easily. It is accordance with the implementation of 21st century curriculum 2013 skills in senior high school which emphasizes that students must be able to understand the interconnections between one concept and another concept in a subject and the interconceptual relationship between subjects with others[2].

Chemistry subject is one of the subjects in curriculum 2013. In chemistry learning, students must learn in three different representations at once, and how to inter-relate each new concept or fact in all three domains: macroscopic, microscopic, and symbolic levels [3], each level is complementary.

The chemistry learning in SMA/MA emphasizes mathematical calculations (symbolic levels) than conceptual learning (macroscopic and microscopic levels) [4]. The disequilibrium on three domains can cause students difficulty in understanding chemical concepts at the basic level, then can cause difficulty in understanding more complex concepts and finally can cause misconception.

The solubility equilibria is one of the chemical matter which often misconceptions [4]. It is caused by that concept is a difficult and complex concept because it requires several concepts such as solution, solubility, chemical and physical equilibrium, Le chatelier's principles, chemical solutions, and chemical equations [5].

Based on preresearch results in three school showed the percentage of students in MAN 1 Gresik who is misconceptions is 76% of solubility concept; 86% of relation between solubility and Ksp; and 68% of common ion effect. Misconception in SMAN Jogoroto is 49% of solubility concept; 52% of relation between solubility and Ksp; and 37% of common ion effect. Misconception in SMAN 1 Pandaan is 45% of solubility concept; 62% of

relation between solubility and Ksp; and 39% of common ion effect.

Misconception can be detected by using three tier diagnostic test [6] which is consists of three tier: the first tier consists of a multiple choice question, the second tier consists of five reason options that refer to the answer at the first tier, and the third tier consists of how the students answer at the first and second tier [7]. The third tier is used to detect whether students are misconceptions or lack of knowledge / guessing answers [8].

Misconception can be reduced by conceptual change text strategy [6]. This is due to the existence of a phase of conceptual conflict creation that causes the schemes owned by students to be disequilibrium [9]. Disequilibrium is a situation where students are unsteady about ideas/concepts that have been understood before, with this situation students must be able to construct the wrong ideas so they can understand the next concepts properly and correctly. The conceptual change text (CCT) strategy consists of four phase, that is: (1) showing the students' conception status, (2) Making conceptual conflict, (3) Equilibration process, (4) Concept reconstruction [10].

The conceptual change text strategy can be conducted by traditionally (Non ICT) and through software (ICT). The using of the conceptual change text strategy traditionally has disadvantage that is less effective because it requires more time than using software (ICT). Meanwhile using software (ICT) is easier to apply and students can repeat learning independently and repeatedly without having to be accompanied by a teacher. Based on previous research the use of software is effective in detecting [11] and reducing misconceptions [12].

Based on the descriptions above, the researcher want to develop of Anti Missoli software to reduce misconception using conceptual change text strategy in solubility equilibria matter.

METHOD

The research method that used is Research and Development [13] which consists of ten phases, that is: (1) Research and information collecting, (2) Planning, (3) Develop preliminary form of product, (4) Preliminary field testing, (5) Main product revision, (6) Main field testing, (7) Operasional product revision, (8) Operasional field testing, (9) Final product revisi, dan (10) Dissemination and implementation. This research is limited to fifth phase, Main product revision.

The research target is Anti Missoli software which was tested to twelve students of class XII science in MAN 1 Gresik that selected based on the preresearch results. This study was conducted in January 2019.

The instruments used of this research are review sheets, validation sheets, student response questionnaire sheets supported by student activity observation sheets, and test sheets. The software appropriateness based of three aspects, i.e (1) validity based on content validity and construct validity, (2) practicality based on student response questionnaire supported by student activity observation, (3) effectiveness based on shifting understanding of student conceptions from misconception to know concept.

The data of validation result are analyzed descriptively qualitatively way by describing percentage in each question. It was assessed by two Unesa chemistry lecturers and a chemistry teacher at MAN 1 Gresik. Its analysis based on Likert scale shown in Table 1.

Table 1. Likert Scale

Score	Category
0	Very less
1	Less
2	Enough
3	Good
4	Very good

[13]

Calculation of each category is analyzed by percentage as follows:

$$P(\%) = \frac{\sum Total\ score\ each\ criterion}{Maximum\ score\ of\ criterion}\ x\ 100\%$$

The data obtained are interpreted using score interpretation shown in Table 2. Software is valid if it gets percentage of ≥61%.

Table 2. Score Interpretation

Percentage (%)	Category
0 – 20	Very less valid
21 – 40	Less valid
41 – 60	Valid enough
61 – 80	Good/valid

Percentage (%)	Category
81 – 100	Very good/very valid

[14]

The students' response questionnaire data are analyzed descriptively qualitatively by describing percentage in each question. It was filled by twelve students who were the subjects in this research and it was given after preliminary field testing. This Analysis based on Guttman scale shown in Table 3.

Table 3. Guttman Scale

Answer	Score for Statement	
	Positive	Negative
Yes	1	0
No	0	1

[14]

Calculation of each category is analyzed by percentage as follows:

$$P(\%) = \frac{\sum Total\ score\ each\ criteria}{Maximum\ score\ of\ criteria} x\ 100\%$$

The data obtained are interpreted using score interpretation shown in Table 4.

Table 4. Interpretation Score

Percentage (%)	Category
0 – 20	Very less practical
21 – 40	Less practical
41 – 60	Practical enough
61 – 80	Good/practical
81 – 100	Very good/very practical

[14]

Software is practical if it gets percentage of ≥61%.

The data of student activity observation are used to support the results of student response to determine the practicality of Anti Missoli software. The analysis based on Guttman scale shown in Table 3. It is analyzed by percentage as follows:

$$P(\%) = \frac{\sum Total\ score\ each\ criteria}{Maximum\ score\ of\ criteria} x\ 100\%$$

The data obtained are interpreted using score interpretation shown in Table 4. Software is practical if it gets percentage of ≥61%.

The data of shifting understanding of student conceptions from misconception to know concept is analyzed descriptively qualitatively way by describing percentage in each concept. The formula used to analyze the effectiveness of software as follows:

$$P(\%) = \frac{\sum MK - TK}{\sum Initial\ MK} x\ 100\%$$

The data obtained are interpreted using score interpretation shown in Table 5. Software is effective if it gets percentage of ≥61%.

Table 5. Interpretation Score

Percentage (%)	Criteria
0 – 20	Very less effective
21 – 40	Less effective
41 – 60	Effective enough
61 – 80	Good/effective
81 – 100	Very good/very effective

[14]

RESULT AND DISCUSSION

Validity

The validation is used to assessed how the validity of the Anti Missoli software can be categorized as a valid media for reducing misconceptions. Software was validated by two Unesa chemistry lecturers and a chemistry teacher at MAN 1 Gresik. The validity is based on the criteria for content and construct validity. The data description of validity results shown in Table 6.

Table 6. Validation Result

Assessment Aspect	Percentage (%)	Category
Content Validity		
Matterial truth	90.00%	Very valid
Video suitability	91.67%	Very valid
Image suitability	91.67%	Very valid
The suitability of the CCT strategy to reduces misconception	83.33%	Very valid
Construct Validity		
Language	88.89%	Very valid
Presenting	91.67%	Very valid
Graphically	93.06%	Very valid

Based on Table 6 can be known that the lower percentage of content validity is the suitability of the CCT strategy to reduce misconception which is 83.33%. It caused in CCT phase 3 (Equilibration process) which contained explanation about the correct concept, at this phase there must be a

component to ensure that students read each frame in CCT. The results of the revision based on validator's suggestion that after students read or observe the material or video in phase 3, students must answer the questions. If the answer was wrong, student would return to the material frame. If the answer was correct, student would give feedback to be more confident about the concept.

Based on Table 6 can be known that the lower percentage of construct validity is language aspect which is 88.89%. It is due to the fact that there is writing that is not in accordance with the Enhanced Indonesian Spelling System, one of it is using of punctuation. From Table 6 can be known that Anti Missoli software is valid, because based on the content validity get the percentage range 83.33% - 91.67% in very valid criteria and construct validity 88.89% - 93.06% in very valid criteria.

Practicality

Student Response Questionnaire

The student response is used to determined the practicality of Anti Missoli software. This questionnaire was carried out by twelve research subject which given after the preliminary field testing. The data description of student response questionnaire shown in Table 7.

Table 7. Student Response Data

Assessment Aspect	Percentage (%)	Category
Presentation interest	95.84%	Very practical
Language clarity	91.67%	Very practical
Learning motivation	83.33%	Very practical

Based on Table 7 can be known that the lower percentage is learning motivation aspect, there were 2 of 12 students who are not interested in learning chemistry after using the software.

Student Activity Observation

Assessment of student activities was carried out by three observers during the preliminary field testing. The data description of student activity observation shown in Table 8.

Table 8. Student Activity Observation Data

Assessment Aspect	Percentage (%)	Category
Students ask questions how to use software	100.00%	Very practical
Students ask questions the function of each button	83.33%	Very practical
Students read carefully each phase in CCT	100.00%	Very practical
The suitability of CCT strategy in reducing misconceptions	83.33%	Very practical
Students observe animation / video carefully in CCT	91.67%	Very practical
Students are motivated to learn each software display	91.67%	Very practical

Based on Table 8 can be known that the assessment of student activities consists of six aspect. The first and second aspect is positive aspect meanwhile the other aspect is negative aspect. The aspect that have lower percentage are second and forth aspect. In the second aspect there are two of twelve students who ask about the function of a button (*Help/Materi*), it is because in the Anti Missoli software there are two choices of its button and students want to make sure which button go to the next phase (reducing misconceptions). The fourth aspect there are two of twelve students who did not read carefully each phase of CCT.

From Table 8 can be known that Anti Missoli software is practical, because the student response questionnaire get the percentage range 83.33% - 95.84% in very practical criteria. This result is supported by student activity observation which get the percentage range 83.33% - 100.00% in very practical criteria.

Effectiveness

The Anti Missoli software output is used to determining the efficiency of the software. The data obtained are shifting understanding of student conceptions from misconception to know concept based on pretest and posttest result. The pretest is used to detecting misconceptions, CCT is used as an effort to reduce misconceptions, and posttest is

used to find out how the students' conceptions shift, whether the conception status changed from misconception to knowing concept or still misconception or not knowing concept.

Students' misconceptions can be explained by constructivism approach. Students construct their own knowledge structures based on the environment, challenges, and material learned [15]. When constructing initial knowledge, it is often not accordance with the correct concept because of the limitations of students in constructing that knowledge. This is accordance with Piaget's cognitive theory that the stages of childrens' cognitive development start from the sensorimotor stage to the abstract stage. The child's thought scheme from the concrete to the abstract stage is still limited in constructing knowledge gained (abstract knowledge) so it cause misconceptions.

Students' misconceptions are resistant or difficult to change [16]. In order the misconception to be truly reduced, the appropriate strategy needed to reduce it, one of it is to use the conceptual change strategy. There are two processes in learning conceptual change, that is: assimilation and accommodation [17]. In the process of assimilation, students use their prior knowledge to accept new knowledge with little change, whereas in the accommodation process students must replace or change their prior knowledge because they do not appropriate with new knowledge [18].

The strategy that used by researchers in reducing students' misconceptions is conceptual change text which consists of four phases [10]. The first phase is showing students' conception status, in this phase students are shown how their conception status after answer the pretest. The second phase is making conceptual conflict, in this phase students given statements taken from the pretest, then students answer whether the statement is true or false. After that the correct concept is explained by given and proven the practicum videos and practicum results data. The existence of this phase causes the schemes owned by students to be disequilibrium because the new concept received is not accordance with the prior knowledge.

The third phase is the equilibration process, in this phase students given an explanation of the correct concept accompanied by the presence of pictures or videos to visualize abstract concepts or concepts that cannot only be explained textually. In this stage students are expected to be able to change their prior knowledge which is not accordance with the correct concept. The fourth phase is concept reconstruction, in this stage students must answer questions according to the concepts described in third phase. If students can reconstruct the concept correctly, their misconception will be truly reduced.

Students' Conceptions Shifting

The data analysis of students' conception shifting shown in Table 9.

Table 9. Students' Conception Shifting Data

Students' Conception Shifting	Solubility			Relation between Solubility and Ksp			Common Ion Effect		
	Question of-			Question of-			Question of-		
	1	2	3	1	2	3	1	2	3
MK-T	5	10	8	7	7	8	6	8	10
MK-TTK	1	0	0	0	0	1	0	0	0
MK-MK	1	0	0	3	1	1	1	2	0
TTK-T	4	2	1	1	1	1	2	1	1
TTK-TTK	0	0	1	1	0	0	0	0	0
TTK-MK	1	0	0	0	0	0	0	0	0
T-T	0	0	2	0	3	1	2	0	0
T-TTK	0	0	0	0	0	0	0	0	0
T-MK	0	0	0	0	0	0	0	0	0

Notes:
MK : misconception
TTK : know the concept
T : don't know the concept

The Anti Missoli software consists of three concepts, that is: solubility concept, relation between solubility and Ksp, and common ion effect. The first concept consists of three question indicators, that is: determining the solubility value based on the definition of solubility correctly, analyzing the statement of solubility concept correctly, and determining the solubility product constant correctly.

Based on Table 9 can be known that the first concept on the first question students who experience positive shift (MK-T) that are five of seven students who misconceptions, the second and third question all students who detected misconceptions experience positive shift (MK-T). The shifting percentage of MK-T first question is 71.43% (effective), second question and third question is 100% (very

effective). So the average percentage students who experience positive shift (MK-T) is 90.48% (very effective). In this concept, the highest percentage of students who experience a positive shift from the three numbers are on the second and third questions, while the lowest percentage is on the first question. This shown that students have not been able to determine the solubility value based on the definition of solubility correctly.

The second concept consists of three question indicators, that is: determining the solubility order of insoluble salt based on the relation between solubility and Ksp correctly, determining of salts which is most easily soluble in water correctly, and determining of salts which is most easily insoluble in water correctly

Based on Table 9 can be known that the second concept on the first question students who experience positive shift (MK-T) that are seven of ten students who misconceptions, the second question students who experience positive shift (MK-T) that are seven of eight students who misconceptions, and the third question students who experience positive shift (MK-T) that are eight of ten students who misconceptions. The shifting percentage of MK-T first question is 70.00% (effective), second question is 87.50% (very effective) and third question is 80.00% (effective). So the average percentage students who experience positive shift (MK-T) is 79.17% (effective). In this concept, the highest percentage of students who experience a positive shift from the three numbers is on the second questions, while the lowest percentage is on the first question. This shown that students have been able to analyze which salts are more easily soluble in water, but have not been able to determine or calculate the order of the salt solubility value.

The third concept consists of three question indicators, that is: classifying the statement which is an example of the addition of common ion based on the definition of common ion correctly, analysis common ion effect correctly, and analysis common ion effect based on the picture that given correctly.

Based on Table 9 can be known that the third concept on the first question students who experience positive shift (MK-T) that are six of seven students who misconceptions, the second question students who experience positive shift (MK-T) that are eight of ten students who misconceptions, and the third question all students who detected misconceptions experience positive shift (MK-T). The shifting percentage of MK-T first question is 85.71% (very effective), second question is 80.00% (effective) and third question is 100.00% (very effective). So the average percentage students who experience positive shift (MK-T) is 88.57% (very effective). The highest percentage of students who experience a positive shift from the three numbers is on the third questions, while the lowest percentage is on the second question.

The effectiveness of Anti Missoli software shown in Figure 1.

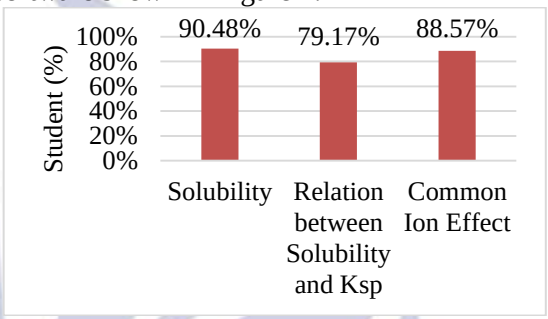

Figure 1. Diagram of The Efficiency of Anti Missoli Software

Based on Figure 1, it shown that the highest percentage of students who experience a positive shift (MK-T) is in the first concept (solubility concept) while the lowest percentage is in the second concept (relation between solubility and Ksp). This shown that students are still difficult to change their conceptions at the symbolic level or mathematical calculation, because in the second concept students required be able to calculate the order of salt solubility based on Ksp and analyze which soluble salt and insoluble salt in water.

Based on Figure 1, it can be concluded that Anti Missoli software is effective in reducing students' misconceptions. This shown from the average percentage students who experience positive shift (MK-T) of three concepts is 86.07%, in very effective criteria.

CLOSURE

Conclusion

Based on the results and discussion of the research, it can be concluded that Anti Missoli software to reduce misconception using conceptual change text strategy in solubility equilibria can be said feasible, with details as follows:

1. The validity of Anti Missoli software on the content criteria get the percentage range 83.33% - 91.67% in very valid criteria and construct criteria get the percentage range 88.89% - 93.06% in very valid criteria. It indicates that the Anti Missoli software is feasible to fulfill the validity criteria.
2. The practicality of Anti Missoli software on the student response questionnaire get the percentage range 83.33% - 95.84% in very practical criteria and supported by student activity observation get the percentage range 83.33% - 100% in very practical criteria. It indicates that the Anti Missoli software is feasible to fulfill the practicality criteria.
3. The effectiveness of Anti Missoli software on the shifting understanding of student conceptions from misconception to knowing concept get the percentage 86.07% in very effective criteria which the positive shift (MK-T) on the solubility concept is 90.48%; the relation between solubility and Ksp is 79.17%; and the common ion effect is 88.57%. It indicates that the Anti Missoli software is feasible to fulfill the effectiveness criteria.

Suggestion

Suggestions for further research are as follows:

1. This research needs to be done further to reduce students' misconceptions in the solubility equilibrium material by sub matter of solubility product constant (Ksp) concept.
2. This research needs to be done further on other chemical materials that have a greater level of misconception, so that the software developed can be used on all chemical materials.
3. This research needs to be done further on the products developed and it is hoped that the media will be hosted on a website so that users can access it any time without having to connect to the admin's IP Address.

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