



(MUDIMA)



## The Development of Computer Supported Conceptual Change Text on Buoyant Force

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### ABSTRACT

The development of computer supported Conceptual Change Text (CCText) is based on a number of misconceptions of buoyant force encountered by students. Computer supported CCT is a technique which is used to correct students' prior knowledge and prepare students for the new and scientific knowledge. Computer supported CCText is started with extracting the initial idea regarding the concept that students had, continued by cognitive conflict stage which functions to challenge the misconception that students had, and then followed by the scientific explanation of the mistakes which have been formulated previously and therefore the students were given the questions to confirm the changed concept that students had at last. This research involved forty participants. The participants consist of senior high school students which divided into two classes; experimental class and control class. The experimental class used computer supported CCText and conceptual change learning model to overcome misconceptions they encountered, whereas the control class only used conceptual change learning model. The result of this research indicates that the experimental class which used computer supported CCText is more significant to reduce alternative conceptions that students had than the control class.

### INTRODUCTION

One of the purposes of learning Physics is to construct the deep understanding from phenomenon therefore students are able to apply it on scientific explanation (Permen, 2006), while according to Ditjen PMPTK (2008), the criteria for successful learning is characterized by the mastery of concept or skill that can be observed and measured. Therefore, in learning Physics, one of the success indicators is students can understand correctly the concept, law, or theory. However, before the formal learning activity conducted in the classroom, students already had several initial understandings from the previous experience which are not entirely correct (Balci, 2006). This students' initial

understanding known as conception, while the conception which is not relevant with the common scientific concept known as misconception (Yulianti, 2004).

Posner (1992) states that, meaningful learning concept must have stages of assimilation which is combining students' prior knowledge with scientific knowledge. According to the statement, Posner, et al (1992), developed conceptual change approach which emphasize on misconception accommodation section that students had (Thalib, Matthews & Secombe, 2005; Chambers & Andre, 1997). One of the sections of the conceptual changes is the use of conceptual change text (CCText) technique (Chambers & Andre, 1997). CCText aims to remediate misconceptions that students have

experienced. In the early stage CCText serves contextual questions to extract the initial concept that students had, after that, confrontation misconception that students encountered was established with scientific concept. Therefore, the students began to experience cognitive conflict where the students began to question the concept which they believed. When students began to experience a crisis of confidence toward the concept that they previously believed, the next step is to accommodate the new concept so that new concept can attach on them replacing the old concept that they had. According to the research carried out by Cakir (2006) and Sevin (2007), they found out that CCText is more effective than other techniques and also can be applied before and after the learning process. Besides, to support CCText, it is recommended to conduct computer simulation appropriate to use in misconception on Fluid issue especially on buoyant force (Unal Coban, 2005). Therefore, this research was conducted to develop computer supported CCText to remediate misconception on buoyant force.

## METHODS

Method used in this research is mixed methods with embedded experimental model design. This research involved 40 senior high school students as the participants which divided into two classes; experimental class and control class. This research consists of 4 stages; needs analysis stage, planning stage, development of computer supported CCText stage, implementation stage, and research interpretation stage. On the needs analysis stage, the researcher analyzed the needs such as previous studies, learning equipment availability analysis on buoyant force, and conception type appointment based on conducted previous studies. On the first product drafting and planning stage, the layout of first product draft was made then developed through making computer supported CCText drafts referred to the characteristics of developed computer supported conceptual change text. The next stage was developing computer supported CCText product. On this stage, the development product was conducted based on the draft made as well as the making of simulation media used. On the implementation stage, evaluation and maintenance

of computer supported CCText, learning process using computer supported CCText, and quantitative and qualitative data collection were conducted. Next is research interpretation stage, this stage consists of qualitative and quantitative data processing, analyzing and discussing the research findings, drawing conclusions, and preparing the report.

## RESULTS AND DISCUSSION

### Computer Supported CCText and the Implementation

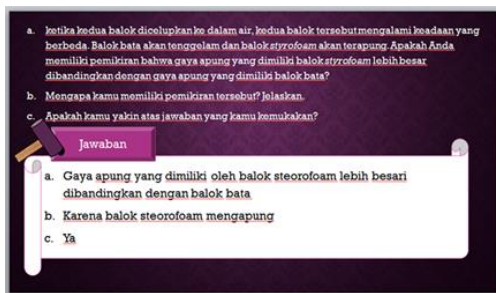
Computer supported CCText was made with several stages. The following are the developed stages.

#### a. First stage

The first stage is identifying misconception. Misconception that will be discussed is “heavy and large objects will sink whereas small and light objects will float”. On this misconception, several communicative questions were presented to explore the extent to which the concepts that students had about buoyant force. Based on the students’ response, it is found that most of students encountered misconception that is buoyancy of floating object larger than sinking objects. When being asked about the reason, most students answered that floating objects are lighter so the buoyant force is larger and the students were sure about that. According to the fact, it is concluded that most students were sure about their answer even though the answer is wrong, so it is said that most students encountered misconception toward buoyant force.

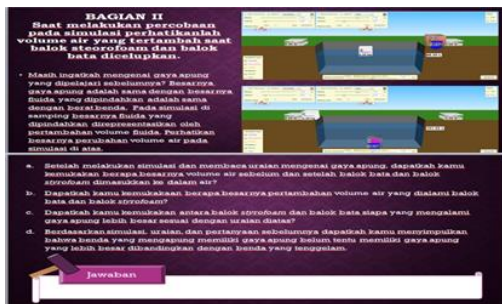


Figure 1. Step 1 Computer Supported CCText with misconception



Picture 2. Student responds a question in Computer Supported CText with misconception "floating objects have a larger buoyancy than a sinking object".

b. Second stage: Cognitive Conflict

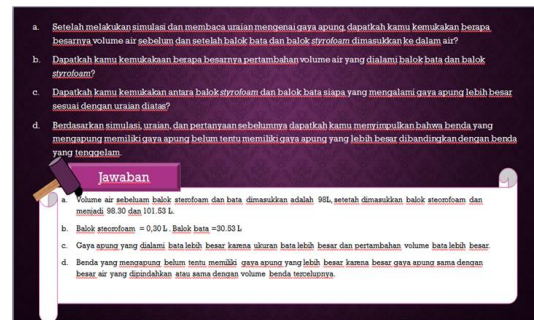


Picture 3. Step 2 Computer Supported CText with misconception

On the second stage, cognitive conflict was presented to challenge alternative concept that the students had with scientific concept. Cognitive concept encountered by students can use virtual simulation. The virtual simulation used can be obtained from PHET. This cognitive conflict decreased students' belief on their initial conception, therefore they tried to review the initial conception they had. This stage became the beginning of the conception change process and will ease conception reconstruction process in students' cognitive structure. Conception reconstruction occurred since the students encounter cognitive conflict until the concept extension stage and students' conception change from misconception to conception that corresponds to the conception of scientists. On this stage, also, students were given questions such as comparison of the answer on identification stage and after the cognitive conflict stage. According to the answer from the students, it is found that students' concept have been already corrected. Therefore, it is said that students began to change their understanding in accordance with scientific concept. However, on this stage, it cannot be said that students' misconception has already replaced with scientific concept, so the next stage is necessary to

embed the scientific concept and replace the students' misconception.

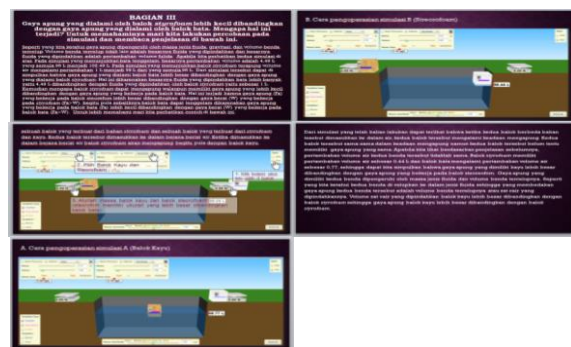
c. Third stage : Scientific Concept Accommodation



Picture 4. Student responds a question in Computer Supported CText at Cognitive Conflict stage with misconception "floating objects have a larger buoyancy than a sinking object".

Third stage is assimilation stage and new concept accommodation which will be embedded to students to replace prior students' alternative concept. On this stage, the concept is clearly explained by using text and virtual simulation as well as other computer supported activities which have been wrapped to accommodate new concept that will be embedded.

Began with general discussion about cases presented on cognitive conflict stage, after that, the activities using virtual simulation or experimental video along with the usage instructions were presented in order to the students can do their the virtual simulation experiment by themselves, so they can assimilate or accommodate the embedded concept properly.



Picture 5. Step 3 Computer Supported CText with misconception

d. Fourth stage

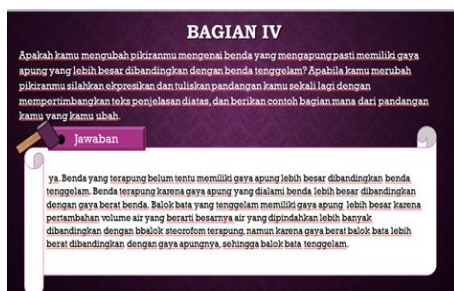
This stage is a stage to expose the change of mind that students encountered. On this stage, the students' opinion was explored regarding the misconception on computer supported CText. Students' opinion at the first stage is identification stage. If the students encountered

such a change of mind about that concept, after passing the second and third stage, students were requested to rewrite that changing concept. This was conducted to accommodate the embedded and instilled new scientific concept by them, to ensure the instilled concept retention was really strong and avoid other misconceptions. Based on the students answer, almost all students alter their view and change their alternative concepts with the scientific one that is instilled in the accommodation stage.

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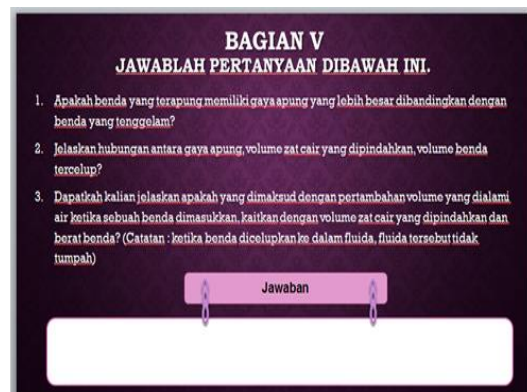
Picture 6. Step 4 Computer Supported CCText with misconception



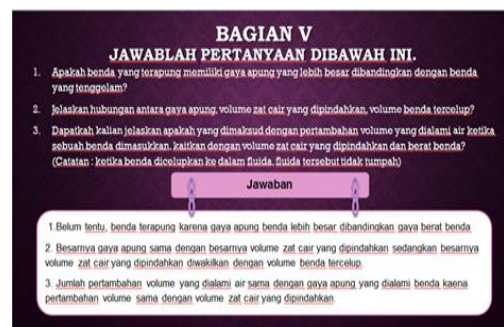
Picture 7. Student responds a question in Computer Supported CCText at review stage with misconception "floating objects have a larger buoyancy than a

e. Fifth stage: Conceptual question

This stage consists of questions regarding accommodated concept. The aim of presenting the questions is to find out whether the students' accommodated concept is clearly understood or only become rote for the students. Aside from containing questions to know concept retention, the stage 5 is also presented questions concerning on the concept expansion which have been accommodated or assimilated by the students. Based on the students' answer, it is known that all of the students have replaced their alternative concept with the embedded scientific concept. On the presented question, students explained that floating object with the buoyant force that works on larger object than gravity and the buoyant force is as large as volume of liquid displaced or volume of the object immersed represented by the increase of the volume of fluid. According to that response, is concluded that all of the students have replaced their alternative concept with the scientific concept.



Picture 8. Step 5 Computer Supported CCText with misconception



Picture 9. Student responds a question in Computer Supported CCText at conceptual question with misconception "floating objects have a larger buoyancy than a sinking object"

## CONCLUSION

To teach the buoyant force using computer supported CCText, illustration is used in the hope that computer supported CCText can deny students' alternative concept by presenting simulation evidence and scientific explanation on it. However, this research has several constraints including the limitation of school's computer facility so that the use of computer supported CCText has not been optimal.

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