Integration of Strategy Conceptual Change Using Strategy 3R (Recall, Recognition and Redintegration) to Reduce Burden High Misconceptions

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Abstract: *Strategy conceptual change and 3R strategy (recall, recognition, and redintegration) already have their respective advantages and support each other, when both strategies are integrated. The purpose of this research is to produce learning strategies that can reduce the burden of high misconceptions in chemistry teacher student. The integration strategy of conceptual change with the 3R strategy is supported by the study of theory and empirical data that illustrate the problems faced by students and students in general and more specifically chemistry teacher student. The test results have misconceptions detection using three tier diagnostic tests found the chemistry teacher student have misconceptions load of more than 50% on the concept of chemical bonding. Students have detected high load misconceptions improved cognitive structure (schema) individually, using the integration strategy of conceptual change with 3R strategy.*

Keywords: Chemistry teacher student, conceptual change strategy, misconception, recall, recognition, redintegration

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A.   Introduction

The misconception has often occurred in students is influenced by external and internal factors. One of the cause's misconceptions in students is the teacher. The statement has been proven by some of the results of previous studies, the results of research Sheehan et al. (2012) state that science teachers have difficulty answering basic questions that should have been mastered. Further it has been found that if the science teacher had difficulty answering basic questions, and then chances science concepts taught to students are still misconceptions. Unal et al. (2010) have found that misconceptions of students on the concept of covalent bonds increased after learning in the classroom. Kolomuc and Tekin (2011) have found that teachers have misconceptions about the concept of rate of reaction. Results were confirmed by the results of research Lemma (2013) that had a significant correlation between the intensity of chemical misconceptions in students and teachers with determination index value of 90%. These results indicate misconception that occurs in 90% of students have been caused by factors misconceptions that occur on teachers, while 10% is due to other factors. Some results of these studies indicate that the misconceptions that have happened to the students more influenced by teachers and other factors, namely books, teaching materials, and the environment.

Constructivist theory has supported the repair process stating that learners (students) personally have come across and implementing complex information, check the new information compared to the old information and improve the information longer if not appropriate. If conception or old information does not match, it is necessary the conceptual change that has been supported by the

cognitive theory of change is through the concept of assimilation and accommodation to occur equilibration. Fixing the conception of the students by using the mechanism of conceptual change in creating cognitive through the accommodation process that has been put forward by according to Posner (1982) there are four requirements that bridges the accommodation process, namely: (1) there must be dissatisfaction with the conception that were owned, (2) a new conception must be understood (intelligible), rational and can solve a problem or a new phenomenon, (3) a new conception must be reasonable (plausible), can solve the problem earlier and consistent with existing theories before, (4) a new concept to be useful (fruitful) in research development or invention. Strategy conceptual change of Posner (1982) resulted in the following four steps: (1) the validation of the concept is wrong, (2) the creation of conditions for cognitive conflict, (3) the provision of assistance to the equilibration, and (4) the reconstruction of student understanding.

Recall process is a process of searching for and finding information stored in memory to be reused when needed. Mechanisms in the process of remembering, helps a person in the face of various problems in learning, especially in students who have the burden of misconceptions. Strategy 3R (recall, recognition, and redintegration) as the mechanism of the process of remembering (retrieval), namely: a) recall, is the process of recall information learned in the past without a clue posed to the students, b) recognition, is the process of knowing back information that has been learned by a user who confronted the student, c) redintegration, is the process of remembering to connect a variety of information into a concept that is quite complex (Hilgard, 1975). Fixing conception of students to use the mechanism in creating cognitive conceptual change through the accommodation process that has been raised Posner (1982) that the accommodation is a conceptual change process because students are not in accordance with the conception of a new phenomenon or a different context. Phase strategy conceptual change that is integrated with strategies 3R (recall, recognition, and redintegration) produces the following stages: (1) validation of the concept is wrong with the recall, (2) creation of conditions for cognitive conflict, (3) the provision of assistance to the equilibration through recognition and (4) the reconstruction of student understanding through redintegration.

B.   RESEARCH METHOD

This research is a case study and analyzed descriptively. Subjects in this study were students with high misconception burden on students of Chemistry Education of Unesa, who have been using purposive sampling technique. Method three-tier diagnostic test has been developed to identify student misconceptions (Arslan et al., 2012). Criteria for grouping students belonging to the idea of the concept (KC), does not know the concept (DNKC), and misconceptions (M). The answers of student responses at each tier show in Table 1.

Table 1. Conception group criteria of student's conception based *three-tier diagnostic test*

Tier1	Tier2	Tier3	Group of Conception	Abbreviation
Answer	**Reason**	**Trust**		
True	True	Sure	Know the concept	KC
True	True	Not Sure	Does not know the concept	DNKC
True	False	Not Sure	Does not know the concept	DNKC
False	True	Not Sure	Does not know the concept	DNKC
False	False	Not Sure	Does not know the concept	DNKC
False	True	Sure	Misconception 1	M1
True	False	Sure	Misconception 2	M2
False	False	Sure	Misconception 3	M3

(Arslan *et al*., 2012)

C.   RESEARCH RESULT

Through identification test misconceptions have been using a three tier diagnostic test, obtained seven students with a visual learning style characteristic verbal balanced and low mental models, have a load of misconceptions over 50% on the concept of chemical bonds are presented in Table 2.

Table 2. Results of misconceptions identification test use three-tier diagnostic test method

Numb	Number of test																			Total	% M
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
1	E	M	M	M	M	M	E	M	M	M	KC	M	M	M	E	M	DNKC	M	DNKC	13	68%
2	E	M	M	M	M	M	KC	KC	M	M	KC	M	E	M	M	M	DNKC	M	M	13	68%
3	E	E	KC	M	M	M	E	M	DNKC	M	DNKC	KC	M	M	M	DNKC	DNKC	M	M	10	53%
4	E	KC	M	M	M	M	M	M	KC	M	KC	KC	E	KC	E	M	M	M	M	11	58%
5	M	KC	M	KC	KC	DNKC	E	M	M	M	M	M	M	KC	M	DNKC	M	M	DNKC	11	58%
6	M	M	M	KC	M	E	M	M	M	M	M	KC	DNKC	E	DNKC	DNKC	M	DNKC	M	11	58%
7	M	M	M	M	M	M	E	M	M	M	KC	DNKC	E	DNKC	E	M	DNKC	KC	DNKC	10	53%

Based on the results of misconceptions identification test, have acquired misconceptions student's subjected to high loads, and must be repaired immediately because the student will become the teacher. If this situation is left unchecked, then it is possible when teachers teach in schools is possible to give the concept that misconceptions in students. To correct misconceptions burden on the chemistry teacher student requires appropriate learning strategies and to solve the problems faced by an individual student. Based on the review of the literature found that the study of theoretical and empirical integration strategy of conceptual change and 3Rs strategy (recall, recognition, and redintegration) has to be used to reduce the burden of high misconceptions in chemistry teacher student .

D.   DISCUSSION
1.   Conceptual Change

According to Posner et al. (1982) conceptual changes have been achieved, when students are aware of the difficulties in conception long held, and a new conception sensible in overcoming the difficulties that exist. A broader view of Posner et al. (1982) stated that the accommodation is a conceptual change process because students are not in accordance with the conception of a new phenomenon. That condition is a fourth requirement that bridges the accommodation process can be described in detail, namely: 1) there must be dissatisfaction with the conception that has been owned by the students, 2) new conception must have been understandable, rational and can solve a problem or phenomenon the new, 3) new conception should be reasonable, has been able to solve the problem earlier and consistent with the theory and knowledge that already exists, 4) a new concept should be useful in the development of knowledge and new discoveries.

Constructivist theory has come to view that individual knowledge is the result of the process of building knowledge based on experience in the system of individual cognition. Constructivism looked at the importance of improving the misconceptions of the students, because: (1) different from the conception of scientific concepts, (2) latent, students continue to be used and tend difficult to change, and (3) difficult to detect by the teacher. Learning in constructivist theory has process of conceptual change, especially if there misconceptions (alternative conception). According to Piaget (in Slavin, 2006) refers to the personal psychology constructivism view, there are three key

processes that have been described previously, by the individual in the building of knowledge, namely assimilation, accommodation and equilibrium.

Constructivist theory has supported the repair process stating that learners (students) personally have come across and implementing complex information, check the new information compared to the old information and improve the information longer if not appropriate. If conception or old information has not appropriate, it is necessary the conceptual change that has been supported by the theory of cognitive change is through the concept of assimilation and accommodation to occur equilibration. The fixing conception of students to use the mechanism in creating cognitive conceptual change through the accommodation process that has been raised by Posner (1982) that the accommodation is a conceptual change process because students are not in accordance with the conception of a new phenomenon or a different context. Phase change conceptual strategy resulted in the following stages: (1) validation of the concept is wrong, (2) creation of conditions for cognitive conflict, (3) the provision of assistance to the equilibration, and (4) the reconstruction of student understanding.

2.   Learning Strategies of Recall, Recognition, and Redintegration (3R)

The strategy of learning from the encoding and storage back to receive and store information, is one of the strategies that can be used in remedial learning process (Eghtesadi, 2010). Furthermore, it has been said this process is important to remember, that decision or carry information from working memory (short term memory) to long-term memory. This process is very important in the process of remembering and recalling information that has been stored is called retrieval strategies. Retrieval strategies have been referring to the involvement of students accessing a memory when the information to be stored in long term memory. The retrieval strategy has two types of processes in learning, namely: spontaneous automated process that brings information into consciousness controlled. The strategy has guided automated information search, starting with the external cues can be controlled and activated by external or internal cues.

Memory has not only the ability to store that happened, but including the ability to receive, store, and lead (Solso, 2005). The ability to receive, store, and reawaken been known as encoding (encoding) to be perceived (receive), storage (storage), retrieval (recovery experienced or learned before). Storage of what is processed in encoding. This storage process is also called the retention is the process of depositing the information that he received in a particular place. This storage is already at the same time including the categorization of information so that the information is stored in a place according to its category.

Retrieval process (recovery or recall what you have stored previously). Recall process is a process of searching for and finding information stored in memory to be reused when needed. A mechanism in the process of remembering has been greatly assist learners in facing everyday problems. Someone said "learn from experience" because students have been able to use a variety of information that has been received in the past to solve the problems it faces today. Hilgard (1975) that three types of process of remembering (retrieval), namely: a) recall, is the process of recall information learned in the past without a clue posed to the students, b) recognition, is the process of knowing back information that has been learned through a instructions are faced with students. c) redintegration, is the process of remembering to connect a variety of information into a concept that is quite complex. The process of considering closely associated with short-term memory and long term memory, because in memory, information is stored.

The strategy is a strategy in recognition memory recall and recognition of whether an item or an event has occurred before in the past. Ameen-Ali et al. (2015) in formulating standards assessment procedures at processing level or depth of encoding has determined the amount of data supplied

spontaneously recognition in memory. During learning, the process of remembering (recall) and recognition (recognition) play an important role to strengthen the concept of memory. Results of research Strom et al. (2010) has revealed the existing knowledge in memory observed through recognition and recall, which is replicated by using concrete nouns. These results explain that, to find a concept is in memory, it can be seen through the recall and recognition. Ghazanfari research results (2014) has clarified that the recall process had significantly higher scores on memory tests. Furthermore Ghazanfari (2014) find if the recall process is carried out continuously in learning, then this condition will help students recall of concepts learned.

Results of research Ochiai et al. (2014) concerning the recall and recognition, has explained that participants were asked to recall and make the news article has been read after two weeks. Explained further that the process of recall and recognition has supported the theory of cognitive psychology is to find information and search concepts can help learner's improve performance in rediscovering saved drafts. This shows that the concept stored in one's memory through redintegration stage. Phase redintegration part in recalling information retrieval strategies through relationships meaningful knowledge. Previous research has considered the process redintegration become an important part of making the concept of memory. Redintegration stage has to be used to consider taking the concept to diterintegrasikan. Lewandowsky (2010) found redintegration and student responses at the time of the recall as a task of making the concept of memory.

3. Strategy Conceptual Change by Strategy 3R (Recall, Recognition, and Redintegration)

Meaningful information has been stored in long term memory in the network of facts and concepts are interrelated called schemata. The important principle schemata theory is that the information entered correctly into the existing scheme, easier to understand, learn, and remember than information which is not entered correctly into the scheme. Information stored into the scheme is information that is still possible misconceptions students and the students have completed the task misconceptions. One important insight into schema theory is that meaningful learning requires the active involvement of learners, who have a lot of experience and knowledge prior to use in understanding and uniting new information. Further explained that what the students have learned from each learning experience is largely dependent on the student scheme applied to the learning experience. Strategy retrieval (recovery or recall what you have stored previously). Recall process is a process of searching for and finding information stored in memory to be reused when needed. An important component of the process of remembering (retrieval) concepts previously learned very important in memory.

The learning process has used remedial learning strategies recall, recognition, and redintegration (3R) highly been required to call and recall a concept that has been stored in memory, and make the complex relationship between the concept of chemical bonds with other concepts. But if the concepts stored in memory are still misconceptions, it is necessary to repair and change the conception of students, from misconceptions (M) became known concepts (KC), of students who experience the burden of misconceptions high a burden on the low misconceptions, to dispel misconceptions. Issues that need to be considered in this study, namely how strategic capabilities recall, recognition, and redintegration (3R) has created a mechanism of change in the conception of the wrong chemical bond on student schemata. Misconceptions experienced by students in the school could be reduced, when the teacher transfer information science correctly, according to a consensus among scientists, that have been able to fix misconceptions of the students, with student misconceptions can be diminished and disappeared.

The fixing conception of students and have used the mechanism of creating a conceptual change in cognitive through the accommodation process that has been raised by Posner (1982) that the

accommodation is a conceptual change process because students are not in accordance with the conception of a new phenomenon or a different context. Phase change conceptual strategy resulted in the following stages: (1) validation of the concept is wrong, (2) creation of conditions for cognitive conflict, (3) the provision of assistance to the equilibration, and (4) the reconstruction of student understanding.

Table 3. Integration of Strategy Conceptual Change Using Strategy 3R
(Recall, Recognition and Redintegration)

Stage learning	Learning Activities
1. Validity misconception through recall	Validating the target student misconceptions experienced, through the process of remembering and recalls any saved drafts.
	Providing awareness to students about misconceptions experienced.
2. Creation of cognitive conflict	Creation of cognitive conflict through the provision of counter-examples.
	Creation of cognitive conflict through a given problem.
	Repetition stages of the creation of cognitive conflict, resulting in a process of assimilation and accommodation.
3. Provision of the equilibration through recognition	Providing assistance to the equilibration by providing questions or additional information that leads individuals to accept that the new conception more reasonable and more useful (plausible and fruitful) than the old conception.
	Creation of cognitive conflict through the video display (facilitating visual) and using text reading (facilitating verbal), in answering the questions (recognition process)
	Facilitating student mental models low on understanding the discourse by providing questions that are reciprocal teaching (recognition process).
	Repetition stages of providing assistance to the equilibration through interviews
4. Reconstruction of individual understanding through redintegration	Reconstruction understanding of individuals, through the provision of contextual questions or questions related to the phenomena in everyday life that demands an answer in the form of an explanation that contains a new conception (redintegration process).
	Reconstruction understanding of individuals, through the provision of argumentative questions that require answers contains a new conception.
	Reconstruction understanding of individuals, through the provision of contextual questions or questions related to the phenomena in everyday life that demands an answer in the form of an explanation containing the new conception through the provision of discourse (redintegration process).
	Reconstruction of individual understanding, analysis of answers to make connections between concepts learned with other concepts in everyday life (redintegration process).

E.   CONCLUCION

The misconceptions identification tests have shown high misconception burden chemistry student teachers FMIPA Unesa on the concept of chemical bonding. These conditions need to be addressed by reducing the burden of high misconceptions through remedial learning and conceptual change strategies integrate with the 3R strategy (recall, recognition, and redintegration). The process has been done by changing the cognitive structure (schema) student misconceptions. The integration strategy of conceptual change with the 3R strategy is expected to reduce the burden of student misconceptions high to low; student misconceptions (M) became known concepts (KC). With reference of Posner (1982) on has created a cognitive conflict to occur accommodation phases of

strategy conceptual change that is integrated with the strategy of the 3R are as follows: (1) validation of misconceptions through recall, (2) creation of conditions for cognitive conflict, (3) the provision of assistance to the equilibration through recognition, and (4) the reconstruction of student understanding through redintegration.

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