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How do students know that they have learned? An investigation of students' strategies

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Abstract

Student self-assessment is an important strategy to involve students into their own assessment process. This paper reports the results of a qualitative study designed to reveal how students know whether they have learned. The participants of the study were 168 high school students. A test comprising a scenario and open ended questions was used as the data collection tool. The answers from the students were analyzed using the content analysis method. Six distinct methods that students used to gather evidence to decide if they learned were identified. They are: self testing, getting help from others, summarizing, repeating, self questioning and explaining to her/himself. In addition, the reasons for using these methods were also revealed. The implications for improving students' self-assessment competencies and learning were also discussed at the end of the paper.

Keywords: self-assessment; metacognition; student strategies;

1. Introduction

Over the last two decades, training students to monitor their own learning has gained importance. One's ability to be aware of and monitor one's own learning process is defined as metacognition (Imel, 2002, Garrett et al. 2007). Self assessment is considered to have a key role in metacognition (Flavell, 1976). Flavell defines two kinds of metacognitive skills; one is self assessment or the ability to assess one's own cognition and the other is self-management or the ability to manage one's further cognitive development. Thus, learners who use metacognitive self-assessment are aware of their abilities and perform better than those who are unaware (Flavell, 1976; Imel 2002).

Self-assessment is defined as involving students into the process of the assessment of their own learning (Olina & Sullivan, 2004; Bloxham & Boyd, 2007; Tan, 2007). Sadler (1989) points out that although a teacher can provide environments to facilitate growth or progress, the student is the one who must take action to close the "gap" between where she currently is in terms of understanding and where she is heading. Thus, students are expected to continuously monitor and evaluate their own learning and think about the ways to improve it (Cariaga-Lo, Richards

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& Frye, 1992; Black & William, 1998; McDonald & Boud, 2003; Srimavin & Darasawang, 2003;Wei & Chen, 2004; Rita, 2005; McMillan & Hearn, 2008).

Research on the effects of self-assessment on learning points out that self-assessment has a potential to improve student performance, and helps develop skills to be life long learners (McDonald & Boud, 2003; Ozogul et al., 2008). Peatling (2000) reports that self-assessment provides students with the information on their own strengths and weaknesses. If students know their own strengths and weaknesses, they can adjust their own thinking according to diverse tasks and, thus, facilitate learning. On the other hand, students who misjudge their performance or do not know that where they lack will not take remedial action or improve learning. Thus, we can say that students' self knowledge or their perceptions and judgments about their own knowledge and skills affect the quality of their learning.

According to Cariaga-Lo et al. (1992) students can use self-assessment both formatively and summatively. They indicate that during a task students first use self assessment formatively to monitor and construct the ongoing task, and then, they benefit from self-assessment once more to see their performance by doing summative evaluation. Similarly, Andrade (2007) emphasized that self-assessment that is done formatively helps find ways to extend learning and increases performance, and when it is summative it serves to give grades to their learning. According to McMillan and Hearn (2008), all these present an ongoing process and include three phases: self-monitoring, self-judgment, and identification and implementation of instructional correctives (Figure 1).

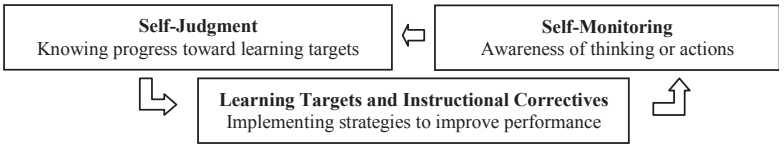

Figure 1. Student Self-Assessment Cycle - I (McMillian & Hearn, 2008).

In self-monitoring phase, students engage in a deep thinking about their own behaviors. Self-questioning is a common strategy used in this phase. Students monitor their own learning by self-questioning to determine whether they understand the material. The second phase, self-judgment, includes identification of understandings from the target and needs. Students ask themselves '*what I know*' related to the topic and '*what I still want to know*' related to their needs considering the pre-defined standards or criteria. The third phase, identification and implementation of instructional correctives, requires to correct misunderstandings by asking themselves '*what I have learned*', and identification of learning goals or actions by asking themselves '*how can I apply my learning to subsequent instruction?*'. Briefly, the first step is related to the identification of own work, and the second is related to the identification of own understandings, and the third is related to the determination of further targets.

In the formative assessment, students receive feedback from their teacher and use it as a reference point to make decisions about the next step. This is quite important for students. However, it is difficult for teachers to give regular and timely feedback to all students when they need (Andrade, 2007). Thus, self-assessment may help students at this point. Students can form their own criteria through asking themselves '*Did I understand?*' or '*Did I learn?*' after the learning activity to identify a reference point, before asking themselves '*What I know*' and '*What I still want to know*'. In this way, they gain insights into their own understandings with a sincere feedback.

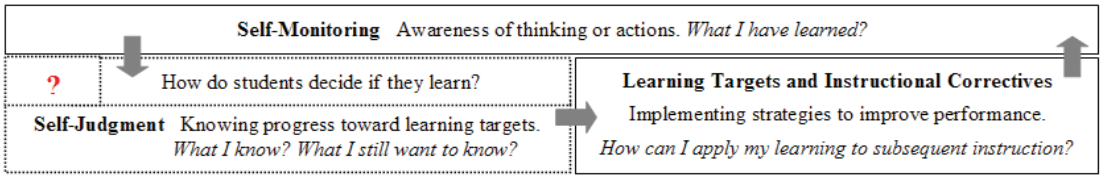

Figure 2. Student Self-Assessment Cycle - II

There are numerous studies showing that self-assessment improves students' learning if they are trained to develop self assessment skills (Black and Wiliam, 1998a; Peatling, 2000; Peat and Franklin 2002;Black et al, 2003; McDonald and Boud, 2003). However, there are no studies that examined students' own strategies to decide if they

have learned. Thus, the objective of this paper is to inquire into strategies that students use to make a decision about their own learning.

2. Methodology

Since the focus of this study is how students decide whether they have learned, the qualitative approach was adopted in principle. 168 high school students in total were participated in the study. The strategies use by the students were determined through a test comprising open-ended questions was used (Appendix I). The initial version of the test comprised a scenario to be completed by the students. The scenario required the students to explain how they would decide if they learned. The test was piloted with 42 students and based on the data from the pilot study, it was revised and improved. The final version of the test contained two sections: a scenario to be completed by the students and open ended questions to reveal their strategies. The open ended questions were formulated based on what the participants of the pilot study reported. While the first section was designed to encourage students to think about 'what and how they do', the second section was designed to encourage students to think about 'why they do'. Content analysis method was employed to analyse the data (Strauss & Corbin, 1990).

3. Results

This section presents the strategies used by the students to assess their own learning and the reasons for using these strategies. Based on the data, the strategies used by the students are presented below (Table 1).

As seen from the table, the students' strategies could be grouped under six main categories: Self-testing (TQ) (85 %), getting help from others (GHFO) (35 %), summarising (SUM) (28 %), repeating (RP) (17 %), self questioning (WAQ) (11 %) and explaining to himself (EH) (8 %).

Clearly, the most frequently used strategy by 85 % of the students is self testing, which involves students' checking their performance against provided test items with right and wrong answers. The students indicated that if they could answer questions related to a topic, that meant they learned. One of the students said "*since the best way to understand if I learned or not is solving problems, I take tests and solve problems.*" (Student 102).

Table 1. The strategies used by the students to decide if they learned (n=168)

Strategy (Descriptive Code)	% (students could indicate more than one strategy)
Self testing (TQ)	85
Getting help from others (GHFO)	35
Summarising (SUM)	28
Repeating (RP)	17
Self questioning (Writing and answering own questions) (WAQ)	11
Explaining to himself (Setting connections between concepts) (EH)	8
Looking at examination results	1

However, as was evident from their own comments, there were two main criteria against which the students using this method evaluated themselves. One was the number of correct answers. The more correct answers they had meant the better they learned. A student said; *"if I have more correct answers than my wrong answers, that means I learned."* (Student 35). The other criterion was the nature of the questions and thereby the depth of learning. The ability to use and apply their knowledge was the indication of learning and, apparently, difficult questions required such ability, as one student said; "*if I can answer a difficult question, it means I understood*" (Student 17). Another said; "*for me, since using knowledge is the indicator of learning, I solve tests and check the number of my correct answers to these questions, instead of memorizing questions*" (Student 46). Similarly, another said; "*While I am solving a question, I try to use my knowledge. If I can use my knowledge, that means I understood*" (Student 5). The students also indicated that by using this strategy they could see the strengths and weaknesses in their own learning and take remedial action; "*Solving questions shows my missing side, and that is important for me to decide"*. Hence, self testing can show students if they learned or not and where they need development.

The second most frequently mentioned strategy was getting help from others (e.g. their parents or friends) by 35 % of the participants. The students needed others in order to ask them questions or listen to them explaining. One of the students said; "*I give my notebook to one of my friends and ask him to ask me questions from the topic I study*"

(Student 53). Some asked help from their parents; "*I ask my parents to listen to me and ask questions to me.*" (Student 134).

Two main reasons could be identified from the responses of the students regarding why they used GHFO. One was getting approval from others they trusted, mainly from their friends or family members. The students felt themselves comfortable if others they trusted approved that they learned, as one student said; "*I feel better if I can answer their questions*" (Student 106). Another reason was ensuring objectivity. Below are the sample comments from the students; *"I want them to ask me questions. If I give correct and adequate answers quickly, I can say that I learned"* (Student 121), "*Answering their questions correctly means that I understand the subject*" (Student 153). "*I feel better if I can answer their questions*" (Student 102)

For about 28 % of the students, the ability to summarize the main points of the material studied was an indicator of learning. One of the students said; "*I check my understanding by summarizing the topic on a piece of paper.*" (Student 96). The summary reflected what they learned, as one said; "*I use summarizing, because what I wrote in my summary is what I understood and the others are my unknowns. Thereby, I can see what I know and what I don't*" (Student 61). Similarly, another student compared his summary with the information in the book; "*After I summarize the topic, I check it from the book*" (Student 19). Hence, by doing such comparison they could see the missing points and take remedial action.

The students in the repeating (RP) category mainly relied on repeating the information as they thought that this was the most effective method to show their understanding. One said; "*Repeating is more effective method to keep in mind, and to see understandings. If I tell, I understood, but if I can not tell, that means I did not understand*" (Student 75). Another said; "*If I tell the subject loudly, that shows I conceived it*" (Student 136).

Self questioning was another strategy employed by 11 % of the students. Self-questioning meant students' formulating and asking their own questions to themselves to monitor what they learned.

Eight percent of the students indicated using "explaining to himself". EH was different from RP in terms of the dept of learning. While students using RP strategy repeated the text as it was written in the book or in their notes, those using EH strategy told themselves what they understood from the text. Thus, RP involved memorising while EH served understanding.

In addition to this categorization, it was also evident from the data that most of the students used more than one strategy to check if they learned. Looking at the data on the combination of the strategies used, it could be seen that self testing was the common strategy used and the others were used by the students to support their decisions. One of the students, for example, combined TQ with GHFO; "*First, I try to solve as many questions as possible and then I give my book to one of my friends to ask me questions from it."* (Student 9).

From the data, three distinct combinations of strategies could be identified. In addition to self testing as the common strategy used, some of the students used getting help from others, while some preferred repeating and explaining to himself and the others used self questioning and summarising. Thus, according to their preferences for the combination of the strategies, the students in the study could be put into three groups; TQ–GHFO, TQ–RS–EH, and TQ–WAQ–SUM. As seen in Figure 3 below, these groups can be presented with a model by placing self testing in the middle as the common strategy used by all of the groups and the other methods around.

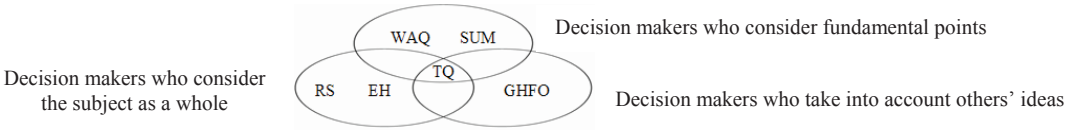

Figure 3. Combination of methods used by the students to decide if they learned

The students in TQ–GHFO group (26 students) first test themselves, and to support their decision they take their friends' or parents' ideas into account about their understanding. The students in TQ–RS–EH group (24 students), however, need to be able to repeat and explain the topic in addition to self testing. The students in TQ–WAQ–SUM group (28 students) focus on fundamental points after testing themselves. If they can summarise the main points and answer the questions of their own after taking tests, that means they learned.

4. Discussions and Conclusions

This study was carried out to reveal how students decide whether they learned or not. The data from the study suggested that the students in the study used self testing (TQ), getting help from others (GHFO), summarising (SUM), repeating (RP), self questioning (WAQ) and explaining to himself (EH) to decide if they learned. The reasons they indicated for using certain strategies were also identified. The main reason for students' preferring one strategy to another was that they thought it was the most effective strategy to check if they learned. TQ was the most frequently used strategy by the students. When deciding with TQ strategy, students considered the number of the correct answers they had and the nature of the questions as well. If they could answer difficult questions or those requiring them to use and apply their knowledge, they thought they learned. While students using TQ made decisions themselves, those using GHFO needed others to decide if they learned. Asking help from others here did not mean that others decided whether the student learned or not. The student asking help made the final decision but approval from others they trusted helped them feel themselves better. Approval from others was also used to ensure the objectivity of their decisions. The students needed others to ensure that they made the correct decision.

In addition to individual use of these strategies, many students used a combination of them and these combinations showed distinct patterns. In all of the combinations, self testing was the main strategy and the others were used to support their decisions. Based on the combination of the strategies used, the students in the study could be put into three groups; (1) TQ-WAQ-SUM: those who consider fundamental points, (2) TQ–GHFO: those who take others' ideas into account, (3) TQ–RS–EH : those who consider the subject as a whole.

In the first group (1), students tended to test themselves first and then summarise the main points. In the second group (2), students first tested themselves and then sought approval from others to ensure that they understood. In the last group (3), students focused on repeating, perhaps involving memorisation as well, or explaining the whole subject to themselves trying to understand it. Similar results were also determined by Yıldız *et al.* (2006) who studied with prospective science and technology teachers to reveal their metacognitive skills. They determined that the student teachers in their study checked their learning mainly by solving questions formulated by themselves, telling what they learned to others and using their knowledge in real life situations. Clearly, students can use different methods to evaluate their own learning as different people have different cognitions. According to Cariaga-Lo *et al.* (1992), since students have various individual characteristics, cognitive processes can be affected by internal or external factors. For example, a student may have introvert or extrovert characteristics that may formalize the self-assessment process positively or negatively. Thus, teachers should be able to identify student characteristics if they want to help students to gain the meaning of the self-assessment process.

Based on the research results, we can ask if 'the strategies that students indicated using provide adequate information to decide whether they learned or not?'. Also, 'do the students have skills to choose correct strategies and to take a right decision on their own learning?'. Such skills are related to metacognitive self assessment which is the ability to assess one's own cognition (Flavell, 1976). Candan (2005) mentioned two main characteristics of metacognition: (a) general background knowledge and (b) strategic backlog. On the one hand, he highlighted that if a student has general background knowledge, he can choose his own strategy to assess the level of his learning, such as formulating questions, forming analogies and/or thinking about emerging similarities. On the other hand, if a student does not have general background knowledge, he considers the subject as a whole with unnecessary details. Students in the third group in this study can be considered in this group. He also highlighted that if a student has strategic backlog, he employees various strategies that mainly focuse on the parts that he perceives as important in the material he studies. Thus, the students who consider fundamental points in this study can be defined under this group. Since metacognition researches provide meaningful results on the perspective of student skills, we may use its results for self-evaluation (McMillan & Hearn, 2008).

To summarise, students, even those without any training on self assessment, may use different comprehension monitoring strategies to make decisions about their own level of knowledge. Based on these decisions they may take further actions. If they find that they did not understand the material, they decide what needs to be done to ensure that they meet the cognitive goal of understanding the material. They may decide to go back and take remedial action with the goal of, for example, being able to answer the questions they had generated. If after the remedial action, they can answer the questions they generate, they decide that they understand. Thus, we can argue that the quality of students' learning is mainly depend on their decisions they make based on the strategies they use to assess their knowledge. Therefore, teachers should be aware of these strategies and introduce self-assessment strategies in

a sensitive and thoughtful manner to students. Thereby, students may develop reflective skills to become self regulated and life long learners.

5. Implication for Future

The literature supports that the use of self-assessment training is one of the efficient approaches to help develop skills to be lifelong learner. The present paper sought to add insights to the students' perspectives on how they decide whether they learned or not. The results of the study will provide a baseline for future studies on this issue.

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Appendix I: TEST

How do I decide whether I learned or not?

A. Please, help Mete.

Mete, a successful student, could not go to school last week since he got flu. However, his friends had exams in science and mathematics. When Mete went to school on Monday, his teacher said to him, "I have to do your exams tomorrow, since I have to assign marks as soon as possible".

After the school, Mete went home and decided to study maths first and then science. He thought that he had to finish all the material covered in maths first especially what was taught in the lessons he missed last week and then he would study science. After two hours' intense study, he could finish all the topics covered in maths. But, there was a problem. Mete could not start studying science because he could not decide whether he learned the topics in maths or not.

If you were Mete, how would you decide whether you learned or not? Why? Please, help Mete by providing information about the strategies that you would follow to make your mind up.

B. Please, complete the sentences that describe the strategies you use.

1. To decide whether I learned or not, I try to solve problems. Because …….
2. To decide whether I learned or not, I ask help from someone else (my mother/brother/friends or *etc*.). Because …….
3. To decide whether I learned or not, I try to summarize the subject. Because …….
4. To decide whether I learned or not, I try to explain the topics to myself. Because …….
5. To decide whether I learned or not, I (please specify other strategies you use). Because …….