Total Student Involvement in Learning Science

Suhadi Ibnu
Universitas Negeri Malang, Indonesia
suhadi_ibnu2007@yahoo.com

Abstract: The under believe that science must be learned through active involvement of students in the construction of meanings of concepts a vast number of studies have been carried out. In line with these studies a number of instructional models have been developed. These models were mainly constructivist in nature in which students were expected to be physically and mentally active in the efforts to develop their own understandings of the studied concepts. Instructional models of this type have been extensively implemented and it was expected that the results were positive in terms of improvement of student learning process and result. However, reports so far published indicated that not all of the models taken into the trials gave satisfactorily results. Among the possible reasons of these poor results was the incomplete involvement of the students in the whole process of learning. The students were only partially involved mainly in the execution phase of learning activities. Effective learning suggests a total involvement of students in the whole process, from being aware of the goals of learning to taking advantage from the knowledge of evaluation processes. This paper suggests a more comprehensive model of learning in which total involvement of students is pursued in the whole process of learning, from the beginning to the end, from the determination of the goals, planning the strategy of learning to the evaluation stages of the learning process.

Keywords: student active learning, concept development, comprehensive learning, comprehensive model of learning.

It has been long since it was first realized that science education suffered from poor results of learning and other weaknesses. Among the most common weaknesses identified up to the current time are poor students' understanding of concepts, the phenomena of misconceptions and low involvement of the students in learning process. Many efforts actually have been undertaken to overcome these. Yet recent studies still reported the persistence of these weaknesses together with other difficulties in the whole business of teaching and learning of science (for instance, Cosztin-Totz, 2011). It seems that the efforts so far attempted have not yet given the expected results. Students' understanding of many essential concepts remains poor and in many cases leads to misconceptions. In chemistry for example, a vast number of misconceptions on various essential concepts like rate of reaction, equilibrium, acid and base concepts, buffer solution ad hydrolysis are still frequently reported, even though various methods from the simple conflict cognitive strategy to the more sophisticated one such as DSLM to overcome this problem have been implemented. Many reported studies indicating these weaknesses can be easily found in the common science education related journals such as Science Education, Journal of Research of Science Teaching (JRST).

The interesting fact which was revealed in the previously mentioned studies was that almost none of those studies have treated the problem in such a way that covered the teaching-learning activities though roughly, from the beginning to the end of the teaching learning activity. Almost all of the study were only partially or incompletely designed that it seems impossible to find a comprehensive explanation about the poor results of learning. It could not

be clearly identified whether the weaknesses emerged from a poor planning, inappropriate implementation or merely weaknesses in the evaluation phase.

A comprehensive model of learning will involve students from the planning phase, such as in identifying the goals of learning activity or learning outcomes. Students will also involve in the implementation phase in the form of monitoring their learning activities and at the end the students will also be involved in designing the evaluation and in analyzing the results of the evaluation.

THEORETICAL CONSIDERATIONS

A number of factors influence the process and determine the results of learning. Traditionally the factors can be divided into three categories, i.e. input, process and product factors. Studies related to the influences of those factors can easily be found in various journals and other types of publication. However it is not easy to find a study which covers all the three categories of factors although it is quite logic and widely known that each factor and the combination of those factors will have a strong impact on the process and results of learning. In this paper the expectedly positive impacts of student awareness of goals of learning or learning outcomes, student knowledge of learning strategy to use in the process of learning and student proper perception of evaluation will be combined in a model of learning. This is an effort to maximize the positive impacts of the factors which so far have been studied extensively though partially and have demonstrated advantageous influences to student learning.

Studies on the impact of student awareness of learning goals can be found in various reports. In general it was reported that student knowledge of learning outcomes gave the students the information of what they have to do and how should they do it which in turn gave the students the opportunity to push themselves to try better as they had already known the points of achievement to reach, and the strategy to be used to achieve the instructional goals. At the same time the students also get the opportunity to weight or to measure their potential to accomplish the task. If they get the positive picture of this is the form of believe that they are able to accomplish the task—a positive motivation will stongly emerge from them. It is line with the concept of the zone of proximal development (ZPD) in which the success of student learning, among other factors, is supported by the learners' believe that they able to reach the defined goals of learning. Like for instance, Grant & Dweck (2003) argued that active learning goals predicted active coping, sustained motivation, and higher achievement in the face of a challenge. This is in line with metacognition believed. Belenky & Nokes (2009), referring to Schwartz & Martin, (2009) indicated that mastery orientation must be present for students to transfer from a direct instruction activity. Recent works have shown that invention activities can promote flexible learning, leading to better transfer after instruction. When students know the goals of learning they have to achieve they will be able to plan their learning more properly.

Leaving the steps of planning phase the teaching-learning bussiness will get into the implementation step. Knowing the goals of learning to achieve and the way they have to go to achieve the goals students will be able to develop a productive and effective learning strategy and to monitor its implementation. It is a part metacognitive activity in which it is believed that active participation of students in managing their learning is an important factor which will take the students to learning success.

Studies in this area are enormous. The results generally supported believe of positive impact on learning process and outcomes. The more intensive student involvement in the learning process the better were the results of learning, measured in various scales such as student process skill ability, critical thinking ability and of course, students' conceptual

understanding. It is argued that students' skills in managing their own learning make the process of learning in their full control. The students will be able to manage their learning according to their own psychological needs and condition such as managing the sequence of learning steps, the speed of learning and the fulfillment of the needed information essential to the construction of concept understanding.

Many studies in the area of metacognition produced similar results. The more sophisticated the students' mastery of metacognitive skills the better were the results of their learning. Arguments supporting the relationship between metacognitive skills and learning results are wide spread. In general the positive impacts of metacognitive skills on learning outcomes was said to have emerged from the control of the students to the ways how learning activities should be managed. Having control on the ways of learning the students could find the most appropriate and effective lane of their own learning. Caliscan & Sunbul (2011) found that learning strategies instruction increased awareness of strategy and metacognitive knowledge and it was effective in using metacognitive skills. It was also found that using metacognitive skills increased achievement. Another study carried out by AL-Baddareen, Ghaith, and Akour (2015) gave evidence those two predictors, mastery goals and metacognition had a significant joint effect on academic motivation.

Knowledge about how assessment or evaluation of learning process and result will be done is also believed to have positive influence on student learning. By knowing this the students will be more prepared to face the evaluation steps and will behave accordingly. The impact will be better if information is also given to the students about the wider and nobler purposes of assessment. Assessment is not only meant for measuring student achievement-more specifically cognitive achievement-but also for improving the quality of learning process and also for providing the students the weaknesses they have so that they are able to develop a plan for improvement. This is in line with the more comprehensive view on assessment in which assessment is not just perceived as 'assessment of learning, but also 'for learning' and 'as learning'. Guskey (2003), based on his study said that teachers who develop useful assessments, provide corrective instruction, and give students second chances to demonstrate success can improve their instruction and help students learn So, providing the students with information about assessment will give three advantages: preparing the students better, giving the students information about their weaknesses and providing the teacher with information of the quality of his/her instructional management. Hanover Research (2014) claimed that studies demonstrate that statement of learning objectives and assessment criteria improve students' self-assessment abilities and, as a result, improve learning outcomes.

THE MODEL

The model consists of three parts representing three phases of learning activity. It must be noted however that all the three phases are actually unpalatable from each other. In the implementation of the model the students will go up and down from one phase to the other as all along the learning activity the students should every time check whether the implementation of the planned learning steps are still in line with the initial plan. The same actions will also be carried out at any phase of learning by referring to two other phases to check whether all the activities are still in good harmony. So it is expected for instance while the students are in the implementation phase they ask questions such as '*Does what I'm doing comply with the purposes of learning formulated beforehand?'* or '*Doe this results of my calculations truly answer the problems set at the beginning of learning activity?*, and so on. Using a diagram the model can be represented as follows.

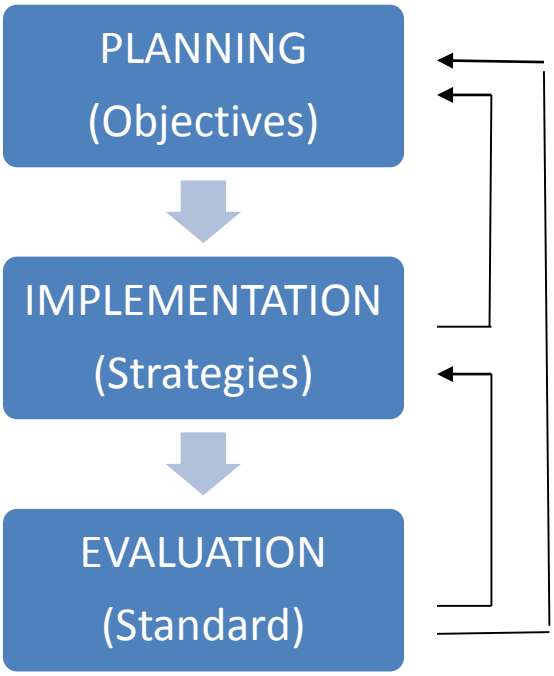

Diagram 1: Total Student Involvement Model of Learning

At a glance the proposed model seems to resemble metacognitive model of learning. It's not at all wrong. However, there is a significant difference with respect to the repetation of benchmarking of each phase to another. In the proposed model benchmarkings are made with two other phases as standards. This reflects the idealized integration of the three phases as parts of an impartial model. By doing this both teacher and students will be able to keep the learning process on track to reach the goals as at any time they have the opportunity to check whether the progress of learning is still as planned or has diverted to other direction or even halted.

TEACHER-STUDENT READINESS

The most significant aspect of learning which will be highly promoted by the model is readiness of both teacher and students to play their roles in the teaching learning process. By always keeping in mind that at all the three phases of learning the students have to undertake teachers should at any time be ready to provide assistance to their students. This wll enable the teachers to analyze the really needed kinds or forms of assistance so that the teachers' actions will be most effective. On the other hand, from the point of view of students learning, the assistance given by the teacher will also be as effective as it is expected as the given assistance is really shoot the trouble the students have at a certain phase of learning. Scaffolding is the teacher's role which should be appropriately implemented in this phase.

In the implementation phase, as the implementation strategy has been properly planned, it will make the learning process of the students really on the right track, although the possibility to take alternative ways is kept open. The strategy should be kept as flexible as possible so that there is still 'emergency exit' when the planned strategy hit a deadlock. The flexibility of the strategy keeps the students and teacher in a high involvement situation mentally, and in such a situation efforts to find a solution can be negotiated between the teacher and the students. Total involvement model of teaching-learning process demonstrates its real characters in this situation.

The evaluation phase will as well promote students active involvement in the process of learning and it will promote a type of assessment which tends to be 'assessment as learning' or at least 'assessment for learning'. In this type of evaluation assessment is not merely designed to produce marks for the students but the assessment is designed to give opportunity to the students to assess whether their learning has run as it is expected. Questions such as whether the students have actively (mentally) involved in the development of meanings of the concepts studied and whether they have developed the correct meaning are common in such a type of evaluation. Having involved in appraisal actions the students will then be able to plan better, implement better and assess their learning more properly in future learning for further improvement of their learning.

SUMMARY

1. The model is student active-constructivist in nature.
2. The model provides an opportunity for the students to plan, control and evaluate their own learning.
3. The model invites students to be mentally active through the whole process of learning.
4. With the implementation of the model it can be expected that the quality of student learning will be improving from time to time.
5. It is an Improvement of related models so far developed.

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