Research Article

COMPARATIVE ASSESSMENT OF ALLOSTERIC LEARNING MODEL AND 5E MODEL PROCESS STEPS

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ARTICLE INFO	ABSTRACT
	The main purpose of this research is to assess allosteric learning model and 5E model process steps by comparing them. The data was obtained by the document review which is one of the methods of qualitative research. Allosteric learning model and 5 Emodel's organizing the learning-teaching process through students' prior knowledge and allowing them to learn through their experiences were found to be outstanding features. Some useful implications are discussed based on the research findings about the effective application of allosteric learning model and 5E model in the learning-teaching process.

INTRODUCTION

The developments occurring in our world in many areas also show itself in the field of education. Today, different methods, techniques, models and approaches are used in education. In traditional methods, when seeking for the transfer of the knowledge and learning by students, cognitive processes and the relationship of these within each other are ignored. However, in traditional methods the necessity to store the existing information in the mind and to memorize it or the learning style just based on teachers' explanation and the books have been out of date (Kılavuz,2005; Şentürk,2010).

On the contrary, new methods, techniques, models and approaches are emerging in order to integrate students actively into the process and carry out permanent learning. Constructivist educational approach has been revealed as a result of the needs of the teaching and learning process. In constructivist approach, it is essential to set up the knowledge from basic and transfer it (Demirel, 2011: 249). It is not only important for students to learn and memorize but it is also necessary to provide students to participate actively in the learning process and perform learning relating the older knowledge. (Bozdoğan & Altunçekiç, 2007). So, students must be within the process by doing and experiencing and must adapt the constructed knowledge to new situations. Education

environments suited to this approach should be offered to the students in order to achieve their learning based on constructivist approach. In order to provide environments based on constructivist learning model, 5E model and allosteric learning model come to the forefront (Ültay & Çalık, 2011; Giordan, 2010). 5E model and allosteric learning model are student-centric models and allow students realize their learning by questioning their knowledge and by doing and experiencing. Both models see learning as a process with the participation of different variables instead of dealing with only one dimension.

5ELearningModel has been developed by Roger Bybee who was the manager researcher of the group 'The Biological Science Curriculum Study-BSCS' in the 1970s. It aims students to discover new concepts and fusing them with the former information (Bybee, Taylor, Gardner, Scotter, Powell, Westbrook & Landes, 2006). Also in this model, students interpret concepts and events together with their views and think about the information they gained from theirown experiences, query and discover (Bilgin, Ay & Coşkun, 2013). Therefore, higher-order thinking skills will be included into the processby the students.

The other model affected from constructivism, allosteric learning model is a biochemical metaphor offered by Giordanemerged in courses in North America and Australia in

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1988.It was derived from the name ""allostérie" which means editing style of an enzyme according to the external conditions (Topbaş, 2013). In accordance with the constructivist approach, allosteric learning modeltries to address different aspects of learning. These enzymes may change form and function according to the environment they are in. The environment, also, has been postulated that it may directly have effecton the mind of an individual (Giordan, 1995). The perception of the world is expressed through attitudes, gestures, methods, values and beliefs called 'conceptions'. These conceptions create mental images and reasoning styles that accompany them. All of them helps the individuals to make sense of the world they are in (Giordan, 2000). The new conception replaces the old one, and thus learning actually takes place. First of all, to do this, the student should deal with the knowledge to learn, meet with the source about it, realize and express, and finally should reach a new conception with a conclusion. Giordan (1995) stated that allosteric learning model has three variables including learner, didactic environment and knowledge.

- The learner prepares the knowledge in accordance with his/her own style and rhythm.
- The didactic environment can be seen as a mixture of elements that maybe nested to convert the structure with behavioral and mental structures of the learner.
- The knowledge is a product of a transformation process and emerges within the process of reasoning.

5E model and allosteric learning model are the models revealed under the influence of constructivist approach. Also in the new curriculum, the constructivist approach has been used as a base. The process steps especially mentioned in the 5E model and the activities ensuring students' researching, questioning, problem solving and decision-making processes have come to the forefront in the new curriculum (ERG, 2005). However, it is seen that the basics of the allosteric learning model put forward by Giordan do not take place in the new curriculum. It is considered to be beneficial to evaluate and compare the process steps of 5E model and allosteric learning model and to use them in learning-teaching process. The lack at this point constitutes the cornerstone of this work.

The purpose of this study is to make a comparative assessment of allosteric learning model and 5E model process steps. Answers are sought for the following research questions in line with this purpose.

1. What are the allosteric learning model and 5Emodelprocess steps?
2. What are the similar and different features of the allosteric learning model and 5E model process steps?

MATERIALS AND METHODS

The data was collected by the document review which is one of the methods of qualitative research. Document review includes the analysis of written materials containing information about the targeted cases or cases (Yıldırım & Şimşek, 2013).

RESULTS

Results and Reviews on the First Sub-Problem of the Research

The results and reviews of first sub-problem expressed as "What are the allosteric learning model and 5E model process steps?"

Table 1 Comparison of Allosteric learning model and 5E model process steps

Allosteric Learning Model	5E Model
Introduction	Engagement
Exploration	Exploration
	Explanation
Elaboration	Elaboration
Transfer	Evaluation

When Table 1 observed, it is seen that while allosteric learning model has four process steps, 5E model has five steps. Process stepson both models also show a similarity. However, the *Explanation* step in5E model isnot included in allosteric learning model but *Exploration* and *Explanation* steps in 5E model meet the *Exploration* step in allosteric learning model. Because in allosteric learning model, Budak (2010) expresses *Exploration* step as students' collecting data on the subject, re-diagnosing the problem, recognizing issues and relevant data in a different way and says that students should develop an idea to have in his mind on the subject. Likewise, the *Exploration* and *Explanation* steps in 5E model are expressed by Ergin, Ünsal& Tan (2006) as students can discover the new knowledge and experience them and also compare their prior knowledge and experiences with the new one and discuss them.

While 5E model consists of *Engagement, Exploration, Explanation, Elaboration* and *Evaluation* steps, allosteric learning model consists of *Introduction, Exploration, Elaboration* and *Transfer* steps. Each "E" in 5E model symbolizes each stage of the model. In 5E model's first step, *Engagement*, generating interest, accessing prior knowledge and connecting to past knowledge are the aims (Aktaş, 2013). The teacher in this step motivates students, creates interest, taps into what students know or think about the topic and raises questions and encourages responses. The students listen attentively, ask questions, demonstrate interest in the lesson and respond to questions demonstrating their own entry point of understanding. In the *Exploration* step, the students experience key concepts, discover new skills, probe, inquire, and question experiences, examine their thinking, establish relationships and understanding. The teacher, also acts as a facilitator, observes and listens to students as they interact, asks good inquiry-oriented questions, provides time for students to think and to reflect and encourages cooperative learning. At this point, the students conduct activities, predict, and form hypotheses or make generalizations. Also, they discuss tentative alternatives (Bybee, 2009). *Explanation* step includes connecting prior knowledge and background to new discoveries, communicating new understandings and connecting informal language to formal language. The teacher, in this step, encourages students to explain their observations and findings in their own words, provides definitions, new words, and explanations, listens and builds upon discussion from students, asks for clarification and justification and

accepts all reasonable responses. Moreover the students explain, listen, define, and question, use previous observations and findings and provide reasonable responses to questions (Tanner, 2010). In *Elaboration* step, students apply new learning to a new or similar situation and extend and explain concept being explored. Also, they provide reasonable conclusions and solutions and record observations, explanations, and solutions. The teacher uses previously learned information as a vehicle to enhance additional learning, encourages students to apply or extend the new concepts and skills and to use terms and definitions previously acquired. *Evaluation* step includes assessing understanding through self, peer and teacher evaluation. This step shows evidence of accomplishment. The students demonstrate an understanding or knowledge of concepts and skills, evaluate his/her own progress, answer open-ended questions and provide reasonable responses and explanations to events or phenomena. The teacher observes student behaviors as they explore and apply new concepts and skills (Turgut & Gürbüz, 2011).

The first process of allosteric learning model, *Introduction* includes students' confronting the issue, comparing the former and the new knowledge, drifting a cognitive imbalance, thinking according to their reality, trying to identify the problem and designing the possible relations. Teachers, in this process, encourage the students mentally to learn and try to persuade the insufficiency of their existing knowledge. Also, they reveal the conceptions of the students, which constitute the fundamental basis of learning and organize the didactic environment according to students' conceptions (Giordan, 1995).

Teachers can do the following in classes to reveal conceptions:

- To make the students draw pictures
- To ask them actual questions
- To make them describe a scheme
- To put them into the negative situations that require reasoning
- To make them do experiment

- To require the similar ones in different models
- To confront them with the paradoxical phenomenon
- To make them discuss
- To make them perform different roles
- To request some definitions
- To confront them with a concept put forth by the students or taken from the history of science
- To take heed of what students tell

In *Exploration* step, it is aimed that students re-identify the problem by collecting data related to the subject and reach a vague integrity by identifying different issues. Teachers try to encourage the students to ask questions and imagine. *Elaboration* step provides students situations where they can test the functionality and limitations of the new knowledge they have learnt and experience it by using. In *Transfer* step, the aim is to show the students that it is easier to learn if the new knowledge is related to former knowledge and useful. It includes activities such as directing students, making them experience, making them evaluate and use.

Results and Reviews on the Second Sub-Problem of the Research

The results and reviews of first sub-problem expressed as "What are the similar and different features of the allosteric learning model and 5E model process steps?

When Table 1 observed, it is note worthy that 5E model and allosteric learning model show similarities in many points. However, in 5E model, the conceptions are not referred only it is specified that the former knowledge will contribute to the learning. *Comparison of Introduction and Engagement Process Steps* In *Introduction* step of allosteric learning model, the prior aim is to persuade the students that they have to learn. Because they come to school with their former knowledge related to the subject to be learnt (Giordan, 2012). For example, when considering any animal nutrition, learning involves students' prior knowledge. But, if the animal is the one which they are not familiar with like a mosquito or jellyfish, the students will

Table 2 The similar and different features of allosteric learning model and 5E model process steps

Process Steps	Features	Allosteric Learning Model	5E Model
Introduction vs. Engagement	Students' interests and attention are taken to the subject to be learned. They are encouraged to learn.	√	√
	The students are made aware of their former knowledge.	√	√
	While revealing the students' former knowledge, their experiences, inquires and investigations can be useful.	√	√
	It is ensured that conceptions of the students are revealed besides their former knowledge. By this way, they are persuaded that their knowledge is not enough.	√	
Exploration vs. Exploration	If the students do not have the prior knowledge about the subject, they can use models to change the abstract models with concrete ones.		√
	It is the step where the students try their knowledge, observe, experience and explore.	√	√
	The student re-identify the problem by collecting the data about the subject and reach a vaguely integrity.	√	
Explanation	The teacher makes explanations about the subject.		√
	The students relate their previous knowledge and experience with new discoveries.	√	√
Elaboration vs. Elaboration	The students relate the knowledge they have learnt with their daily life by applying it to different situations.	√	√
	In order to make the new knowledge functional, experiences that students might use the new knowledge are provided.	√	
Transfer vs. Evaluation	It is shown the students that it is easier to learn if the new knowledge is related to former knowledge and useful	√	
	The students' evaluating and using the new knowledge is aimed.	√	
	The students make inferences by questioning the new knowledge.	√	√
	Self/peer/teacher evaluation is done in order to see the old knowledge is replaced with the new one.		√

drift into an imbalance and will be convinced about the lack of their knowledge about the subject.

In *Engagement* step of 5E model, it is aimed that students mentally deal with an object, a problem, a situation or an event. The activities in this step should link up with past experiences and reveal misconceptions of the students and aim to reduce cognitive imbalance (Bybee et al., 2006). Asking questions, identifying a problem, showing an incompatible situation and role-playing a situation are the methods that can be applied to arouse students' interest in the courses. Moreover, the teacher's roleat this stage is to present the situation to the students and create rules. For example in *Engagement step*, to draw attention to the strength and movement subject, the teacher distributes an interesting story at the beginning of the course ask questions on this subject. To occur a confusion in students' minds and get them motivated for the learning activities are targeted.

Comparison of Exploration (Semi-Constructivism) and Exploration Process Steps

In *Exploration* step of allosteric learning model, it is aimed that students re-identify the problem and reach a vague integrity by identifying different issues and related data. Teachers, in this step, try to encourage the students to ask questions and imagine. After the students are convinced and their conceptions are released, they search for the new concepts about the nutrition of different animals and explore where the new concepts should be used by forming questions.

In *Exploration* step of5E model, students should be given time to discover after they become interested in the course. The imbalance occurred in Engagement step gives its place to a balance (Türk and Çalık, 2008). This step must be concrete and the data should be formed. Especially, the students must be confronted with the mental activities that make them physically active like an experiment. As a result of interaction with these activities, students establish relationships, observe the examples, define variables and events question the events. If there is a need for the teacher, he/she guides them about re-identifying the problem. An experiment which is about the different surface's different friction and kinetic energy differing is made by the students and various questions are asked.

Comparison of Elaboration (Constructivism) and Explanation/Elaboration Process Steps

In *Elaboration* step of allosteric learning model, situations where the pupils can test the functionality and limitations of the new knowledge they have learnt and experience it by using are provided for the students (Budak, 2010).About the nutrition subject the students are expected to relate their knowledge with everyday life on the subject and make conversations by discussing at this stage.

In *Explanation* step of 5E model, the concepts are made simple and understandable. About the strength and movement subject, the teacher wants the students make explanations and at the end the teacher makes the definitions directly if necessary. In *Elaboration* step of 5E model, the conceptual learning and abilities are developed. With new experiences, they obtain broader and deeper knowledge on the subject (Bybee, 2009). In addition, more activities to deepen learned knowledge are

given at this stage. For example, by asking a question like "What is reason of fitting wheels to the items such as a suitcase, a vacuum cleaner or a desk used in everyday life?" students can consolidate their knowledge about the subject of strength and movement.

Comparison of Transfer and Evaluation Process Steps

In *Transfer* step of allosteric learning model, it is shown that it is easier to learn if the new knowledge is related to former knowledge and useful. It includes important activities such as directing students, making them experience, making them evaluate and use the knowledge learned (Giordan, 2010). About the nutrition subject, the nutrition systems of the animals that the students have learned can be directed and used by them for the similar animals' nutrition systems.

In *Evaluation* step of 5E model, the students use and evaluate the knowledge they have obtained. Also, they get the feedback about the explanation they have made in this stage. The teachers determine their students' learning levels. To evaluate the acquisitions of the students, teachers can use diagnostic tree on strength and movement subject.

CONCLUSION AND DISCUSSION

The following conclusions are obtained in the light of the findings in this study of which purpose is to assess and comparethe5E model and allosteric learning model process step:

As an answer to the first sub-problem expressed as "What are the allosteric learning model and 5E model process steps?" it is found out that the process steps show similarities in many points. While allosteric learning model consists of four process steps, 5E model includes five process steps. As both models are formed and affected from constructivism, they have a lot of parallel issues. However, according to Giordan (2012) the most distinctive feature of allosteric learning model from 5E model and other models affected by the constructivist approach is the prominence of student interaction.

As an answer to the second sub-problem expressed as "What are the similar and different features of the allosteric learning model and 5E model process steps?" it is concluded that both are effective in the process of acquiring high-level skills such as reasoning, exploring and creative thinking. On the other hand, in allosteric learning model, the conceptions are often mentioned in the process of acquisition of new knowledge and it is necessary to understand these conception correctly in order to maintain the process actively and permanently. In contrast, in 5E model there is no mention of the conceptions, just the former experiences and knowledge of the students are involved in the learning process. Inallosteric learning model the learners build their knowledge slowly by making the knowledge meaningful, enhancing and creating relationships between information in the did active environment designed by their tutorials. The did active environment gives a certain autonomy in the face of their own learning. If the learner has to get exterior support in this environment, he/she is responsible for his/her own learning. Also, 5E model presents an environment where the pupils can experience things. They explore themselves and obtain permanent learning as in allosteric learning model. In the study done by Gürbüztürk, Koç &

Babaoğlu (2015), it is found out that allosteric learning model has a positive effect on problem solving skills of the students. Besides, Ergin (2009) gets the finding in his study about 5E model that the academic success and remembering rates of the students improve with 5E model.

The following suggestions maybe revealed based on data obtained from research

- Considering the importance of critical and creative thinking emphasized in both models, opportunities of both models also can be benefited in designing the teaching-learning process.
- Models suggest several methods and the tutorials can take action by using these methods and identifying the students' conceptions and obstacles resulting from them. Also they can benefit from the former experiences in teaching-learning process.
- When the experts prepare the curriculum, they can include the process of revealing conceptions, which is an essential point in allosteric learning model.

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