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¹O.Zengin, ²Zh.S.Kalkabekova, ²A.A.Ganyukova

¹Kahramanmaras Sutcu Imam University, Turkey;

²Ye.A.Buketov Karaganda State University (E-mail: aneta.2011@mail.ru)

Constructivist classroom activities for biology learning in English

There are many learning theories in the educational process of teaching-learning. Constructivism is unique because it focuses on developing the learners' knowledge by constructing the world around them through experience, observation, documentation, analysis and reflection. This article contains the review of many classroom activities such as using concept maps, scenarios and songs, making up charts and schemes, case study which encourage thinking, understanding, exploration, problem solving, collaboration, analysis, observation and prediction.

Key words: constructivism, school education, biology teaching, classroom teaching, classroom activities, biology, education, learning, student, science.

In the classrooms of today, learners neither are no longer passive recipients nor are the teachers the all knowing 'givers of information, knowledge and wisdom' [1]. According to constructivist perspective, the teaching or rather more precisely learning of biology is not the search for the ultimate truth. It is the process which is of utmost importance in biology than the content. So when the learning of biology involves active construction of knowledge by children, then the classroom environment must call for more synergies rather than mere individual participation. The teachers need to develop the ability to work with children creatively to generate new ideas, new theories, new products and new knowledge. The engagement of the learner in the construction of classroom activity requires inputs from a reflective teacher and meticulous pre-planning before a unit is transacted in the class. Strategies of peer learning through group work, small work and whole class work are important, again depending on task and the teaching objective. Learner autonomy and respect for individual learners is mandatory if real learning is to take place. Encouraging learners to reflect and question their own understanding further aids comprehension. This article contains the review of many classroom activities which encourage thinking, understanding, exploration, problem solving, collaboration, analysis, observation and prediction.

So, let us regard the notion 'constructivism'. Constructivism is a learning theory based on scientific observation and research and explains how people learn. They construct their own knowledge of the world around them through reflection on their experiences. When we are faced with new knowledge, we tend to relate it to our previous experiences and either modify our ideas or discard the new information. In the pro-

cess we tend to create new knowledge by asking questions, explaining and assessing what we already know. Constructivism as applied to education is a more recent development derived from the work of development psychologist *Jean Piaget (1973)* and Russian psychologist *L. Vigotsky (1978)* [2]. Its underlying principles are also influenced by the developmentalist ideas of the French philosopher *Jacques Rousseau* and later the theories of *John Dewey*, *G. Stanley Hall* and *Arnold Gessell*.

Constructivism in Biology Education

From a constructivist perspective, biology is not the search for truth. It is a process that assists us to make sense of our world. Using a constructivist perspective, teaching biology becomes more like the biology that biologists do; it is an active, social process of making sense of experiences, as opposed to what we now call «school biology». Indeed, actively engaging students in science (we have all heard the call for «hands-on, minds-on science») is the *goal of most science education reform*. It is an admirable goal, and using constructivism as a referent can possibly assist in reaching that goal. In a constructivist epistemology

- tools available to a knower are the *senses*. It is only through seeing, hearing, touching, smelling and tasting that an individual interacts with the environment. With these messages from the senses the individual builds a picture of the world.
- Experience involves an interaction of an individual with events, objects, or phenomenon in the universe; an interaction of the senses with things, a personal construction which fits some of the external reality but does not provide a match.
- A cooperative learning strategy allows individuals to test the fit of their experiential world with a community of others. Others help to constrain our thinking. The interactions with others cause perturbations, and by resolving the perturbations individuals make adaptations to fit their new experiential world.
- The process of learning should not stop at what has been learned in the negotiation of a class consensus. This process can involve accessing other learning resources such as books, videotapes, and practicing scientists.

Constructivist Classroom activities in Biology Learning

Knowledge is constructed by the learner, not received. How does knowledge construction (i.e. learning) take place? Learners come to biology learning with existing ideas about many natural phenomena? What ideas do learners' bring to biology classes?, and what is the nature of these ideas? Each individual has a unique set of ideas. How much commonality is there between learner's ideas in biology? The learners' existing ideas have consequences for the learning of biology. How do learners' ideas interact with teaching? It is possible to teach biology more effectively if account is taken of the learner's existing ideas. How should constructivist' teachers teach biology? There are a number of ways by which teachers can come to know about the previous knowledge of students. Some exercises are mentioned in this section:

1. Concept maps. In the study of Biology, the ability to build interrelationships among concepts and related topics, and to relate newly acquired knowledge to prior knowledge, is crucial to the understanding of biological concepts and how the systems work together to bring about a coordinated response. Concept maps, diagrams and other graphic organisers are useful tools to illustrate the links between concepts and topics. Once a teacher has explained ecosystem, ask students to connect the following terms: *ecosystem, biotic components, abiotic components, soil, water, air, decomposed organic matter, CO₂, N₂, O₂, water, climatic conditions, temperature, producers, consumers, decomposer, food-chain, energy flow, recycling of nutrients and biogeochemical cycles*. Every term should be connected with arrows labeled with a word that describes the link between the processes — example: change, causes, provides, directs, etc.

When students are able to discover the links between concepts themselves, they move away from rote or surface learning, and replace it with deep and meaningful learning, thus increasing the level of understanding and an appreciation for the subject. This encourages cooperative learning also.

2. Use of newspaper articles in making T-charts. Tell students to bring newspaper articles about science. List the topics of the articles on the board as the students give a 30 second summary of their article. From this list choose 5–6 topics which are relevant for them. Make 5–6 groups of students and allocate one topic to each group. Give each group instructions to make a T-chart on a large piece of chart paper. Tell them that a T-chart is a large T drawn on the paper...with the topic written at the top of the T. On one side of the T bar students will write — what have you heard about the topic? On the other side they will write — what questions do you have about the topic?

Now you can discuss these T-charts either in the construction of the concept maps or can understand their previous knowledge to initiate discussions in the class.

3. Scenarios. You are discussing homeostasis in living organisms. The students are now part of a multi-disciplinary team put together to design the perfect animal that can survive and reproduce successfully under the following conditions: an environment that is very hot and dry during the day, but turns cold and windy at night, and that has many fast and aggressive predators. In their design of this animal, they should consider integument, body support, reproductive strategy, excretion and mode of locomotion.

In this exercise students need to think, work in a group, discuss and apply already covered/taught topics like adaptations, thermoregulation, morphological features, lifeprocesses, defense mechanism etc. This requires structuring and restructuring of concepts which is possible only with good understanding of concepts. Learning benefits from multiple views of a subject area.

4. Graphs. After studying human growth, ask students to draw a graph of average growth after birth showing the relationship between heights (in cm.) and age (years). Once they have made this graph then tell them to plot a graph of male and female comparative growth rates showing the relationship between change in height (cm/year) and age (years). This graphical representation helps in better understanding and interpretation.

5. Brainstorming. When reviewing thermoregulation, ask students to come up with five ways in which snakes can prevent overheating on a hot summer day. This exercise helps in developing thinking skills, structuring and restructuring of conceptual knowledge.

6. Observations/Predictions. When you are about to explain the hormonal control of female reproductive system, show an illustration of hormonal control of female reproductive system and ask students to make a list of six observations. When you discuss the positive and negative feedback systems controlling the production of estrogen and progesterone by the ovary with the students, they have already spent time studying the names of different glands involved and hormones produced by them and will be more receptive to learn more about the role of hormones in ovulation and menstruation. Then, ask students to predict what would happen to the endometrium if progesterone level does not fall during the last days of the menstrual cycle? This exercise will help students in observation, comprehension, analysis, interpretation and prediction.

7. Problems. This problem is designed to help students understand the functioning of the circulatory system in the human body. Suppose you are staying on the second floor of the building and due to low pressure of the water, the water reaching your taps is not sufficient. Then you are advised to install water pump at your house. Predict:

- What will happen?
- What if there is any blockage in the water pipes supplying water to your house taps?
- What will happen if you now shift to the ground floor flat?

This activity provides an analogy to understand circulatory system in human beings. This helps in better understanding of the organ system (circulatory system) as well as its functioning.

8. Use of Cartoons. Use of cartoons in classroom teaching can make learning joyful. One page cartoons can be shown to the students like a cartoon showing a small boy holding his stomach with both hands and his face is looking very painful. On one side of the boy is shown the inner view of his stomach. Inside the stomach a lot of bacteria are jumping and releasing a lot of gas [3]. Now teacher can ask questions like:

- what is happening in the stomach of this boy?
- name that part of the digestive system in which these bacteria are present.
- name the foods which are likely to produce more gas.
- how can we avoid flatulence/stomach discomfort?

This exercise helps in making learning an enjoyable experience. The engagement of learners, through relevant activities, can further facilitate in the construction of mental images of the relationships (cause-effect).

9. Songs for teaching biology [4]. There are many songs which can be used for promoting learning in a joyful manner. One such song is given below:

Ecosystems*Science Maniacs**(Chorus)**I've got a big pond in my backyard**It's my own little ecosystem working hard**All the organisms are part of the food web**They play specific roles to make sure that they all get fed**The grasses growing on the edge and the algae in the water**The producers photosynthesize with light, CO₂ and water**CO₂ is in the air, the light comes from the sun**They produce the oxygen and the food needed by everyone**(Chorus)**Some snails eat the algae and some snails eat the grass**They're the primary consumers cause they eat only plants**And even when the grass has died there's still some energy left**For the decomposers, dead things are what they like best**(Chorus)**The fish eat the snails and the turtles eat the fish**And every time that one of them eats it only gets 10 %**So every gram of turtle needs 10 grams of fish**A gram of fish needs 10 grams of snails to fulfill its energy requirements**(Chorus)**An ecosystem relies upon this energy pyramid**It takes an awful lot of plants to let 1 turtle live**1000 plants, 100 snails, 10 fish would be just right**To keep 1 turtle well fed and it all starts out with light**(Retrieved from <http://www.songsforteaching.com/biologyecology/ecosystems.htm>)*

Thus, constructivists claim that we have no access to an objective truth and that all knowledge is subjective and dependent on the learner. From a constructivist perspective, science is not the search for truth. It is a process that assists us to make sense of our world. Using a constructivist perspective, teaching biology becomes more like the biology that biologists do — it is an *active, social process of making sense of experiences*. It is an enjoyable activity and the role of the teacher is very challenging [5].

Learning in classrooms is facilitated by well designed activities. These activities offer the opportunity to examine the problem from a variety of perspectives and also to collaborate. Listening to the multiple views on the subject makes the understanding better [6]. Through different classroom activities, students get an opportunity to reflect and build on and consolidate existing knowledge. Students get an opportunity to construct knowledge. Just as teachers have to learn how to teach from a constructivist point of view, so too must students learn how to learn. Educating students to be effective learners is an important priority in establishing environments conducive to effective learning of biology.

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О.Зенгин, Ж.С.Қалқабекова, А.А.Ганюкова

Ағылшын тілінде биология сабағын оқытуда конструктивизм әдісін қолдану

Мақалада ағылшын тілде жаратылыстану пәндерді оқытуда көбінесе теориялық бағыттар бойынша әр түрлі әдістерді негіздеу мен ұсыну сұрақтары көрсетілген. Авторлар конструктивизм әдісінің бірегейлігін студенттердің әлемнің құрылысын эксперимент, қадағалау, құжаттар, синтез және деректерді талдау арқылы қарастырған. Сондай-ақ кейбір әдістер келтіріліп, игерушілікті концептуалды картаның, сценарийлерді және әндердің, кестенің және нобайдың құрылысын, мақсаттың шешімі, жағдайдың дамуы жолдары сипатталған.

О.Зенгин, Ж.С.Калқабекова, А.А.Ганюкова

Использование метода конструктивизма в преподавании биологии на английском языке

В статье отмечено, что существует множество теоретических направлений, предлагающих и обосновывающих те или иные методы в преподавании естественных дисциплин на английском языке. Авторами рассмотрен метод конструктивизма, уникальность которого заключается в формировании знаний у студентов при помощи построения мира вокруг них посредством экспериментов, наблюдения, документирования, синтеза и анализа данных. Приведены и описаны некоторые методы: использование концептуальных карт, сценариев и песен, построение графиков и схем, решение задач, развитие ситуаций, способствующих развитию мышления, усвоению и закреплению полученных знаний.

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Г.С.Шрайманова, П.З.Ишанов, А.М.Затынейко, Д.И.Абдульманова

Карагандинский государственный университет им. Е.А.Букетова (E-mail: d_i_abdulmanova@mail.ru)

Содержательный аспект категории «формирование» в общенаучной и педагогической парадигме

В статье рассматривается сущность понятия «формирование» в общенаучной и педагогической парадигме. Раскрываются этимология термина и содержательный аспект данного понятия в контексте современного этапа социально-экономического развития общества. Авторами проанализированы подходы к раскрытию сущности категории «формирование» ученых, занимающихся данной проблемой, и понятия данной категории, представленные в толковых словарях различных направлений. Выделено определение изучаемого понятия, которое используется авторами в своей научно-исследовательской деятельности.

Ключевые слова: понятие, содержание, формирование, определение, сущность, педагогика, подход, категория, процесс, этап, стадия, изменение.

В современных условиях становления мирового образовательного пространства особое значение приобретает совершенствование системы высшего образования. Основная направленность современного образования характеризуется, с одной стороны, заботой о качестве образования, а с другой — поиском условий поддержки студента как будущего специалиста в самоактуализации, раскрытии и развитии его личностного потенциала, продвижении студента внутри профессиональной программы [1].

Тенденция к непрерывному усложнению и расширению деятельности современного педагога существенно повышает требования к его профессиональной компетентности. Сегодня педагог должен обладать таким комплексом профессиональных компетенций, которые позволили бы ему стать