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**DESIGNING LESSONS FOR NATURAL SCIENCE SUBJECT
IN THE SECONDARY SCHOOL USING EXPERIENTIAL METHOD**

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Abstract. This article analyzes the nature of experience and experiential learning by doing. Based on that, designing process for Natural Science subject in the secondary school including analysis of the content of the subject and planning of experiential learning is offered; cases for experiential learning are designed; experiential activities of students in a certain process are designed and experiential results of students are assessed.

Keywords: experience; experiential learning; experiential teaching; Natural Science; secondary school; lesson design.

I. Statement of the research problem

In Vietnam education reform started in 2011. In 2017 the general education program was issued. At secondary school there is a new subject Natural Science, which is integrated into three subjects in the current program: Physics, Chemistry, Biology [1]. This course very well suits to the experiential learning. However, due to a new subject the organization of experiential learning poses many challenges for teachers.

To organize experiential learning for students teachers have to conduct at least three major stages: (i) *planning and designing the units of experiential teaching*; (ii) *organizing students activities in cases*; (iii) *confirming results of students' experiences and trends in new experiences*. In particular, planning and designing the units of experiential teaching are considered as the basis, premise and strong impact of the remaining stages and

effectiveness of the whole process of learning organization.

This raises the issue of identifying the process of experiential teaching students the Natural Sciences subject in the secondary school according to the new general education curriculum.

II. Content

2.1. Experiences in education

What is experiential learning?

The common concept of experiential learning is learning by experiences. Learners are "dipped" into an experience, encouraged to reflect on those experiences to develop new skills, attitudes or ways of thinking [10; 11; 12]. Experiential learning is the process whereby knowledge is created through the transformation of experience [4]. Regarding to J. Dewey, experiential learning is a tectonic way of learning, a process of experiential reconstruction or reorganization in order to

improve meaning for experience and capacity to control a process of experience that will happen later [2].

Full understanding, experiential learning is the process of new experience creation based on real experiences, assessments and analysis of past experiences. Experiential learning is opposite to academic learning ways. It is a process of gaining information via researching a problem without direct experience.

2.2. Design of experiential lessons for student in Natural Sciences in secondary school

In the new general education curriculum, at the secondary school, the content structure of the natural sciences includes subdivided subjects (physic, chemistry, biology) and interdisciplinary subjects. Those contents are arranged mainly by linear logic with a combination of some concentric knowledge [1].

Thus, the natural sciences are highly integrated and are well suited to experiential learning. The issue is to organize learning by doing for students, and first of all how to design effective lessons for students.

Here is the process of designing experiential lessons for students at the secondary school in the Natural Science subject.

2.2.1. Step 1: Analyzing the content of the subject and anticipating the appropriate forms of experiences

All of learning actions are linked to certain contents and have clear objectives. To do

so teachers have to understand contents of subject clearly. Knowledge, skills, and capacity need to be formed and developed for students using suitable learning methods. Knowledge and topics could be learned by experiences. It means that teachers and students need to have plans about topics and experiences in subjects as well as in every detailed content. In order to do that teachers must analyze contents of subject and predict appropriate forms of experiences.

There are two activities for teachers in this step:

(i) Analyzing content of lessons according to certain criteria

Analyzing content of lesson is a form of “document reconstruction”, which is the way to penetrate document, reflecting on the material in a positive way. From that, to imagine the demand of knowledge and skills that students need to reach; learning methods of students suit with every content of subject.

The analysis of subject content depends on the level of expertise, experience and style of each teacher. However, the general requirement is that teachers must identify the forming source and nature of knowledge in the subject; layout appropriate learning methods and results to be achieved after learning. Based on the results of the content analysis, teachers should establish a unit of knowledge in Natural Science for students in the secondary school. Refer to the Table 1:

Table 1

Unit of knowledge in the Natural Sciences for students in the secondary school

N	Unit of knowledge	Source and nature of knowledge	Appropriate learning method	Achieved results after learning			
				Knowledge	Behavior	Skills	Capacity
1							
2							
...							
n							

The origin of knowledge formation could be from an axiom (a priori knowledge) or from an earlier experience (postmodern knowledge). Nature of knowledge could be purely theoretical, academic, informational, and may be of the nature of the action (nature of experience). From the origin of formation and nature of knowledge, teachers could visualize the appropriate learning and teaching methods: learning by transmitting and receiving; guiding method – skill training or experiential learning method.

The value of analyzing and mapping the unit of knowledge helps the teacher understand the content of the student's learning documents, visualize the goals to be achieved, and anticipate learning methods suitable to each type of knowledge. This will

lead students to study the science they are in charge of. At the same time, the content of knowledge and topics should be learned in an empirical way in order to develop appropriate capacity in students.

(ii) Expected types of experience corresponding to each type of knowledge, topic of course.

As an analyzing result of the subject content, teachers should visualize and set up a list of types and types of experiences appropriate to each learning content in accordance with the experiences and characteristics of students' psychophysics as well as the circumstances. From there they form the Table of Experiences in Natural Science for students at the secondary school. Refer to Table 2.

Table 2

Types and forms of experiences in Natural Sciences for students at the secondary school.

№	Learning content and topics	Types and forms of experiential learning and achieved requirements				
		Types of experiences	Forms of experiences	Conditions and equipments to prepare	Time and location	Educational results to reach
1						
2						
....						
n						

It is a difficulty and also a weakness of experiential learning, which is a preparation for an experiential activity, especially on-the-field experiences [10]. So be proactive and have time for it. Determining the type and form of experience for topics of subject is a highly active strategy for both teachers and students. Teachers should identify and communicate with the students, the school, and the involved educational resources, in relation to each topic, what the type of experiential learning to be held, with what the form of experiential learning (experiences in the

classroom or in the field, experience in the form of games, role-plays, experiments, individual or group, etc.). Along with identifying the type and form of experiences, these are the corresponding preparatory tasks.

The value of prediction of types and forms of experiences that help teachers, schools, students, and other involved educators to proactively plan and prepare the necessary conditions for experiential activities of students; help students become more proactive and active in their own learning.

2.2.2. Step 2: Designing experiential cases for students

The character of the experiences is related to the situation. Experiential learning is that students conduct experiential actions in a specific situation in order to find a solution to the situation [13; 2]. Thus, the design of the experiential situation is the first step, which is decisive for experiential teaching and also the hardest task of the teacher in experiential teaching.

Requirements of an experiential case in teaching Natural Science.

Experiential situations are different from normal learning situations, in that there are characteristics or requirements that ordinary learning situations do not necessarily have.

Experiential goals need to be high, clear, explicit. An experience has the potential to bring results in different directions (cognitive, emotional, value, etc.). This can easily distract the mind and put away from the study subject. Therefore, the first requirement of the experiential situation is to account for its purpose. When designing a situation, the teacher needs to determine what the main goal of the experience is physical development, knowledge, emotion, capacity or value, etc. Determining the objective of the experience will determine the context of the situation; regulates the mobilization of experiences that exist in the student, regulates the actions of experience and reflection in the action of experience; determine the direction of the teacher's support and evaluation the student's experience

The situation must be the action system (job) or the response of the individual (or group)

Experiential learning is the implementation of actions in situations. This is because of the experience and experiential learning required. However, in the experiential situation, the actions of students are structured differently than actions in normal learning situations. These are experiential, experimental; Reflective and reflective [2; 3]. The system of action is designed in a sequence of

trial and error, in which the first action is derived from the experience that has and often leads to error. The system of action must be diverse and inclusive, including practical actions, observational actions, reflection, reflection and action. That is, the situation must come from the needs and towards the needs of the students, stimulating excitement and in accordance with the psychological-physiological characteristics of the students. [17]. The situation includes both goals, content and solutions that students need to achieve at the level of understanding [13]; it is situation of teacher's trust in teaching [20]. The situation consists of two levels: difficulty and hindrance, corresponding to two levels of assimilation and intellectual conditioning. [18] or current developmental level and developmental level [19].

The situation is more closely linked to the practical situation as the higher the value.

Experiential learning can be carried out on hypothetical situations (virtual situation). However, education is life, education is geared towards the growth of personal experiences [3]. Thus, experiential situations are linked to realities, taking material from the lively realities of social life, the value of education and development of student's reality are higher and higher.

To design an experience-based scenario that meets these requirements, the teacher needs to determine the purpose and content of the experience; identify the areas of experience, knowledge, skills students have, need to mobilize to solve the situation; the needs, interests, excitement and other psychological characteristics of the student in relation to the situation will be designed; anticipate the actions and solutions students will take; level of difficulty, obstacles students will encounter; the results of the actions and corresponding responses of students about the results achieved; visualize the experiential situation; environment, circumstances will take place; the material, facilities, equipment and the teacher should prepare when dealing with the situation. Then, build a scenario and test.

2.2.3. *Designing activities of organization for students undergo in cases*

To effectively organize the student's experiential actions in the designed situation, teachers need to do a variety of tasks:

Learning contract

The first way of experiential teaching to students in a situation is to implement a learning contract between the teacher and the individual and the student group [20]. Essentially, the terms, jobs, obligations of teachers and students are public. Students need to know as much detail as to what to do, what conditions are available; requirements and results; shared questions and student commitment, as well as necessary support from teachers and friends, etc. They also need to know the role and support of teachers in the process.

The development of the experience may change some of the contract. Therefore, teachers should provide the necessary adjustments to suit the practical implementation of student learning experiences.

Organizing students to implement experiential action

There are many models of student behavioral experiences in situations [3; 4; 7; 11]. The general characteristics of the models are as follows: (i) Action on the subject in a defined situation. The nature of the actions (actions) depends on the situation and the experience of the learner. The results of these actions create initial experiences for the learner (experience here and now). They become important "input materials" of subsequent actions. (ii) *Imaginary observation. This is the core of the learning experience. Observation can take place during action, possibly after action.* Students need to suggest observation and reflection to reconstruct the discrete experiences that have been acquired with the events of the event, to link those events and experiences to the experience that has been previously. At this stage, the teacher's suggestion of suggestive questions plays a very important role (for example, recall the experience that has existed?) What does this

have to do with something? (iii) *Conceptualization.* On the basis of comprehensive observation, and linking different experiences, students analyze them, flip over the problem, form new concepts, new knowledge, new solutions. This is an important step in shaping the experience. Without this step, experiences will not be able to be upgraded and develop to a new level, more useful than just minor experiences acquired during the learning or practice process. (iv) *Extreme, is the act of verifying the theoretical hypothesis that was drawn earlier.* New concepts, new knowledge, new solutions drawn by students through the search activity above are just hypotheses, may be true, may be wrong. The next step is to test the hypothesis in new actions, new circumstances to verify. Then, there is new experience, and they become the inputs for the next round of learning, until the learning reaches the initial goal.

Strengthening and regulating the experiential action of students in the situation

One aspect that teachers should keep in mind when organizing experiences for students is motivation, reinforcement, motivation, and counseling to help them adjust inappropriate behaviors in the experience. Teachers need to anticipate the support, orientations and use of existing experience; open questions; Motivational incentives will be used in student action situations. In experiential learning, motivation, motivation for students is crucial. According to B. Skinner, the art of teaching is the art of reinforcing the actions of students [5].

2.2.4. *Establishing standards and assessing results of experiences following to targets and requirements of subjects as well as experiences*

The strength of the experiential learning is that students are free to mobilize and develop their full potential, experience and knowledge in solving situations. However, there is no standard and tool for evaluating the results and the effectiveness of the experience as learning activities. One of the tasks of the teacher is to set standards for the re-

quirement for experiential learning; standards of goals and results to be achieved during and after the experience. Simultaneously, the student's experience is evaluated as a learning activity in the school.

III. Conclusion

Experiential learning is appropriate nature and principle of tectonics in children under the anaerobic and adaptive mechanisms [17]. The mechanism of cultural and psychocultural functions is formed through the use of cultural tools, transforming social experience into personal experiences through action and practice [19]. In teaching development, learning experience is the effective learning method.

In the new general education program, Natural Science was first taught in the secondary school. So, for teachers and students, it is difficult, challenging.

To effectively implement the experiential learning for student in the natural science subject, the teacher should understand the nature, origins, and principles of experience, experiences and experiential learning. Based on that, applying the analysis of learning content, to identify the topics of experience, types, forms of experience; to sign experiential and organizing for students to implement experiential actions following to a defined cycle. In which, design experiential scenarios and suggest organizational process are prerequisite activities.

Bibliography

1. Ministry of Education and Training (2017), general education curriculum.
2. John Dewey (1998) Experience and education: The 60th Anniversary Edition by Kappa Delta Pi. International Honor Society in Education.
3. John Dewey (1997) Democracy and Education, An Introduction to the Philosophy of education; New York: The Free Press.
4. Kolb D. A., 1984. Experiential learning: experience as the source of learning and development. Address: Englewood Cliffs, New Jersey; Publisher: Prentice - Hall.
5. Skinner B. F., Science And Human Behavior, The Pree Press and colophon are trademarks of Simon & Shuster, 1953.
6. Tolman E. C., Priciples of purposive behavior, Mc Gaw - Hill. N.Y, 1959.
7. Jennifer A. Moon, (2013). A Handbook of Reflective and Experiential Learning: Theory and Practice. Published by Routledge Falmer, Canada.
8. Colin M. Beard, John Peter Wilson, 2006. Experiential Learning: A Best Practice Handbook for Educators and Trainers. Kogan Page Publishers.
9. Kohler W. (1925) The Mentality of Apes. New York: Harcourt Brace Jovanovich.
10. Lewis L. H. & Williams C. J. (1994). In Jackson, L. & Caffarella, R.S. (Eds.). Experiential Learning: A New Approach (pp. 5–16). San Francisco: Jossey-Bass.
11. Scott D. Wurdinger, Julie A. Carlson, 2009. Teaching for Experiential Learning: Five Approaches That Work. Published by Rowman & Littlefield Education, America.
12. Scott D. Wurdinger, 2005. Using Experiential Learning in the Classroom. Published by Rowman & Littlefield Education, America.
13. Wertheimer M. (1959) Productive Thinking. New York: Haper & Row.
14. Lewin. K (1951), Field theory in Social science, New York: Harper & Row.
15. Phan Trong Ngo - Le Minh Nguyet (2017) Experience and learning experience in teaching. Journal of Education Science, No. 146, November - 2017. Tr. 8–13.
16. Orientation to use in organization of creative experiential activities. Journal of Science, Hanoi National University of Education, Vol 62, Issue 1A, 2017. pp. 48–57.
17. Lecne I. Ia. (1977) Problem-Based Learning (In Vietnamese). Education Publishing House.
18. Piaget J. P. (1952) The Origins of Intelligence in Children. New York.: Internationnal Uneversities Press.
19. Vygotsky L. S. (1978). Mind in Society: The Development of Higher Psychology Processs. Cambridge, MA, MIT.
20. Comiti, Claude (1991) Cours de DEA sur les difirents rôles – du maitre, project de redaction, 10 fevrier.

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