Letters to the Editor
Писма до редакцията

THE TEACHING METHOD NAMED "STARTER-EXPERIMENT-APPROACH"

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A lot of researchers are trying to find a way how to motivate students to learn science. There are different methods proposed. Nowadays there is a trend to use computers and other electronic devices in daily life and it is also applied in the teaching and learning process, also there are a lot of researches about technology impact on teaching and its necessity to prepare teachers to teach science and mathematics with technology (Niess, 2005; and Sarfo et al., 2017). New multimedia technology provides us with the opportunity to create a virtual world for experiments. A nice way to motivate students for learning science is suggested by Mistler-Jackson & Songer (2000) through telecommunications programs such as "Kids as Global Scientists". As Brekke & Hogstad (2010) says "you need to carefully investigate what works and what does not work, and then fit it into your own pedagogically platform". But it is necessary to give students the opportunity to experience hands-on real experimenting in the teaching and learning process, especially when the students do not have previous experience with experimenting. More importantly, the virtual experiments deny students to develop their creativity, and thus, their interest and motivation is at risk.

There are different types of education methods for teaching and learning science and mathematics, each of them has their advantages and disadvantages. The teacher should be (on) able to distinguish which method is more useful to be used for a specific case.

The Starter Experiment Approach, SEA, is based on student centered principles and is an appropriate method to teach science and mathematics on different levels of education, especially for students in secondary schools and in universities as well.

The Starter Experiment Approach, SEA

The name "Starter Experiment" is used because this method starts from observation of phenomena obtained from the environment or from an experiment. Some methodological rules ensure that all students of the class will participate either

in individual work, group work, class discussions, or presentations. The activities follow the scientific cycle as shown in Fig. 1. Students' attempted explanations for the observations will be confronted with the results of the verification experiments allowing students to give up their pre-concepts and to replace them by the concepts which were found in the course of the lesson.

This makes learning meaningful and motivating (Jean Piaget, "What is learning") (Mistler-Jackson & Songer, 2000).

The SEA method was developed by Jürgen Schönherr, alias "Papa SEA", a German educator, who dedicated part of his life to research and development in the field of science and mathematics education.

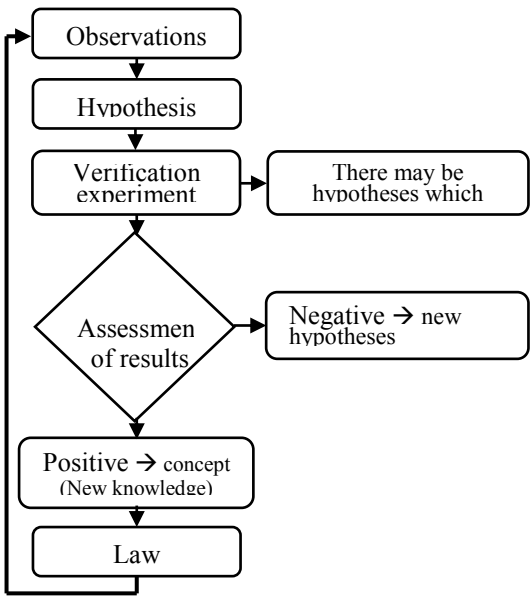

Figure 1. Scientific cycle

The Starter Experiment Approach follows the "Scientific Cycle". Comparing the steps of the Scientific Cycle with the steps of the SEA method will show how closely they are interlinked. Here is the short description of SEA's steps: (i) *Observing* phenomena either directly in the environment or through an experiment; (ii) *attempting to explain* why certain things were observed, students using their pre-concepts to formulate their hypotheses*;* (iii) *verifying/falsifying* the attempted explanations (hypotheses) by means of experiments, preferably designed by the students themselves; (iv) *assessing* the attempted explanations by means of the results of the verification experiments; (v) *formulating a concept* in case of a positive

assessment of the hypothesis or *formulating a new hypothesis* in case of a negative assessment of the original hypothesis, which is followed by a new verification process; (vi) *linking the concept* to students' environment and its applications in technology and science; (vii) *evaluating* students' degree of comprehension of the newly found concept.[1)]

Effects of SEA on students and teachers

The first reaction of the students when experiencing a science or mathematics lesson following SEA is very convincing: They are happy to become the subjects as active learners. All become active no matter their gender or previous position in the ranking within their group. Motivation "jumps up" and produces a long lasting change of attitude by the majority of students towards science subjects and mathematics.

In turn, teachers will observe some changes in their own attitude towards the lessons they have to give. They will observe that they spend more time thinking about these lessons, they will spend more time preparing them, they will become more open to students' questions and suggestions, they will find teaching satisfactory and rewarding.

Some other effects frequently observed: (a) students become more tolerant towards deviating ideas of classmates; (b) students become more supportive among each other; (c) girls are more respected and are actively involved in lessons traditionally regarded as the domains of boys; (d) the positive attitude towards science subjects and mathematics *spills over* to other subjects.

Due to the training element *Mutual Monitoring***,** which is part of the SEA training**,** the cooperation amongst teachers increases.

Each new chapter of the syllabus or the textbook shall be started by a good starter experiment. The proceeding lessons may follow more traditional methods esp. when laboratories and equipment is rare. This experimental method does not require advanced laboratory equipment.

Thus, the SEA method is also suitable to be applied in countries with low or medium economic development.

Enforcement of SEA

The Starter Experiment Approach is a wide spread teaching and learning method already in use in different countries. Training courses for SEA have been conducted in Indonesia (Indrayati et al. 2014), Philippines, Tanzania (Kitta, 2015), Kirgizstan, Tajikistan, Bosnia and Herzegovina.

Planning the implementation of SEA in Kosovo started beginning of 2001. In cooperation with Kosovo's Ministry of Education, Science and Technology (MEST) and sponsored by the German NGO, "RENOVABIS" 312 teachers from 152 schools were trained and three local trainer teams of 5 trainers each were estab-

lished during the time 2003 to 2009. With the years 2010 until 2014 the program shifted gradually into the ownership of the Kosovo government.

Implementation of SEA at the Faculty of Mathematical and Natural Sciences, University of Prishtina "Hasan Prishtina", Kosovo

Due to the good yield results of students from schools where SEA is implemented, some universities have already adopted SEA for their pedagogical platform, like the Indonesian universities of Semarang, Jogjakarta and Singaraja, the University of San Carlos (Philippines).

In 2008 the academic staff of the Faculty of Mathematical and Natural Sciences (FMNS) at University of Prishtina "Hasan Prishtina" (Kosovo) underwent training in the SEA method for teaching and learning in science subjects and mathematics in order to adopt SEA for the methodology training of their teacher students (Table 1).

Table 1. Students number of enrolled and graduated by years

	Enrolled		Graduated		
	2015/16	2016/17	2013/14	2014/15	2015/16
Female	381	389	164	86	176
Male	223	214	128	75	135
Total	604	603	292	161	311

If we have a look at the registered number of first year students at FMNS, it is obvious that it has increased by the years. From the academic year 2014/15 and following it seems to decrease as shown in Fig. 2.

The reduction of registered students from the academic year 2014/15 is due to changes of educative legislation by government. Based on new legislative system FMNS had to offer only one program, as a result of this legislative some study programs had to be closed.

The fluctuation of enrolled and graduated students by genders in different years is shown in Table 1. Of course, the number of girls has increased comparing with previous years.

In the last academic year (2016/17) the competition to enroll in the first year of FMNS was four candidates for three places. This is the highest value recorded ever on FMNS. This may be the effect of the use of SEA in an increasing number of schools in Kosovo.

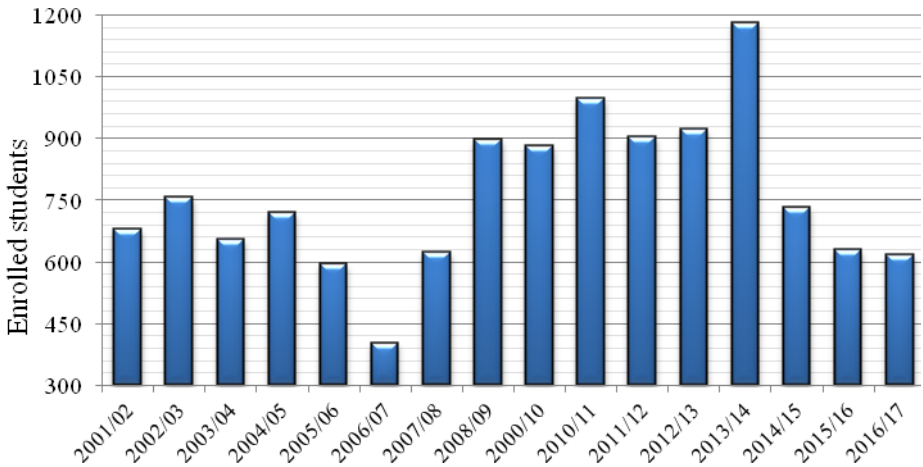

Figure 2. Enrolled science students at first year on FMNS by years

Conclusion

From 2003 when the SEA method is introduced in Kosovo's school system, respectively from the academic year 2008/09 started to be applied at FMNS there are some significant benefits, those benefits are not linked only to SEA method but its contribution is significant.

Some of recorded benefits are: average scores of students are higher; the average time for finishing studies is shortened; the number of interested students to follow science and mathematics among the girls is increased.

In the future more attention should be given to the SEA method. A proper research for analyzing its impact on the teaching and learning process esp. by comparing the performance and attitude of students at schools where SEA is already implemented with schools, where SEA is not yet used.

Even without the results of this research, we propose to continue with the SEA in-service teacher training program in the whole country. Teachers of primary and secondary schools must be given priority to attend SEA trainings.

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NOTES

1. There is a slightly different procedure for mathematics which is not shown here.

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