OPEN ACCESS
EURASIA Journal of Mathematics Science and Technology Education
ISSN 1305-8223 (online) 1305-8215 (print)
2017 13(1):223-236
DOI 10.12973/eurasia.2017.00613a

Scientific Research Activity of Students Pre-Service Teachers of Sciences at University: The Aspects of Understanding, Situation and Improvement

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Received 21 June 2016 ▪ Revised 27 September 2016 ▪ Accepted 13 October 2016

ABSTRACT
The development of student abilities of scientific research activity (SRA) in the process of studies appears as a highly important area. In the course of studies, students not only increase their general competencies, acquire professional abilities and skills but also learn to conduct research. This does not mean that all students will build their careers in the field of scientific research in the future. The present life, labour market, the complexity of technology, etc. require at least minimum competencies in carrying out investigation. SRA should be universally stimulated and developed. Scientific research activity is not an entertainment but responsible, thorough work requiring a lot of self-independence. Such activity promotes student analytical thinking, the abilities of searching and using information are formed, they learn how to analyse the collected material, prepare reports, make research presentations, etc. The conducted qualitative research involved graduated students – pre-service teachers of sciences studying at Lithuanian universities. The research was conducted in January-February 2016 and based on the constructivist paradigm, suggesting that knowledge was not the final or uniform product. Teaching is an effective tool when students gain information thus stimulating active cognitive processes. The performed research has demonstrated that SRA questions remain crucial, the organization of such activity has specific weaknesses and improvement is not always carried out deliberately and purposefully, because the context, environment, conditions and requirements for education in general may differ. Improvement on SRA is not possible without empirical data based on the status. The research has revealed student understanding of SRA, its key strengths and weaknesses as well as allowed assessing the significance of such activity on the professional training of the pre-service teacher and on improving guidelines.
Keywords: qualitative research, scientific research activity (SRA), teacher education, university students

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State of the literature

- Scientific research activity (SRA) becomes the reality of teacher's educational practice, allowing the analysis of specific learning situations, creating preconditions for reflecting individual actions and educational interaction with students and making available to ascertain the efficiency of the lately applied teaching methods.
- World practice shows that studies at university are grounded on science, by them it is sought to prepare an educated man, compatible with the present world demands.
- Students' SRA is determined by research activity competence, acquired during theoretical and practical studies: lecturers' active study methods'usage, preparation of a course paper or bachelor work and so on. However, there is lack of exhaustive research studies about bachelor study students'scientific research competence education in the study process.

Contribution of this paper to the literature

- The context of SRA understanding by the university students pre-service teachers of sciences is analyzed.
- SRA promoting / limiting factors were analysed and extracted using a qualitative approach.
- Some important factors, strengthening students' motivation to actively participate in scientific research activity have been identified.

INTRODUCTION

The development of the abilities of scientific research activity (SRA) during university studies is an undoubtedly important area still requiring serious attention. A crucial point is to promote and activate student scientific research activity thus broadening and deepening their knowledge of science, improving the already acquired competencies and training them for effective work at secondary school. The carried-out research demonstrates that SRA significantly contributes to their professional development by providing opportunities to apply the knowledge acquired at the university in a real professional environment and to courageously move forward according to the selected academic area (Bernadic, Mladosievicova, Traubner, 2004; Lamanauskas, Augienė, 2014). The full implementation of potential synergies between faculty research and undergraduate education also plays a substantial role (Prince, Felder, Brent, 2007).

A communique issued by the ministers responsible for higher education (2009) provides that, up to 2020, higher schools will be pursuing the unity of education, research and innovation. The document emphasizes that higher education at all levels should be based on modern scientific research and their development. Moreover, public authorities and higher schools must pursue the career of young researchers should be attractive enough. Thus, more and more attention should be paid to broadening student scientific research skills and to developing critical thinking, creativity and expression of productive development.

Recent scientific research competence is essential to many of occupations and activities. Therefore, yet a bachelor's degree student must acquire adequate scientific research

competence. Studying appropriate course units helps students to gain the basic skills of scientific research competence. Apart from what has been said above, motivating and developing student need to participate in scientific research activity and envisaging the importance of this activity for a successful professional career are essential points.

Scientific research activity becomes the reality of teacher's educational practice allowing the analysis of specific learning situations, creating preconditions for reflecting individual actions and educational interaction with students and making available to ascertain the efficiency of the lately applied teaching methods.

Teacher-mastered SRA competencies enable to explore the ever-changing situations, actively and consciously participate in them and predict changes in trends. A teacher-researcher constantly reflects his/her individual activity, organizes research on educational activity, employs different research methods and creatively applies research results (Caena, 2011). Recently, speeches and documents (Mokytojo profesijos kompetencijos aprašas, 2007; Common European Principles for Teacher Competences and Qualifications, 2010) prepared by education policy-makers and works done by Lithuanian and foreign scientists (Lepeškienė, Butkienė, Steevens, Werkhoven, 2001; Pollard, Anderson, Maddock, Swaffield, Warin, Warwick, 2008) have put a particular emphasis on the objective of the teacher to develop research activity and to become a teacher-researcher in educational practice. Teacher's competence in scientific research has a double meaning and importance, because s/he must thoroughly master the scientific method of reality cognition, to carry out applied research and succeed in leading student scientific cognitive activities thus engaging them and encouraging exploration (Pečiuliauskienė, 2008). Student scientific research activity can be easily organized by the teachers that have experience in this field and manage to effectively create scientific research situations when students are engaged in research activity itself and when satisfaction in the search process is promoted.

The research object is scientific research activity conducted by the student's pre-service teachers of sciences at the university. Thus, the performed research is aimed at analysing how pre-service teachers of sciences understand SRA, at their motivation for such activity, at displaying the factors limiting/promoting such activity and at a possibility of identifying possible improvement methods.

METHODOLOGY

General Characteristics of Research

The research was carried out between January and February 2016, i.e. at the beginning of the second term of studies. The research is based on the attitude that student opinion and the assessed research play an important role due to the fact that they allow establishing urgent problems and clarifying the already known ones. Referring to the analysis of the proposals made by the students, the ways of finding a solution to the problem and the assessment of possible consequences should be suggested. Investigation into opinions is an

effective means seeking to initiate changes, in this case, to improve scientific research activity of the students pre-service teachers of sciences. This examination is based on the previously conducted expert research (Lamanauskas, Augienė, 2014; Lamanauskas, Augienė, 2015).

Research Instrument

The questionnaire (answer sheet) prepared by the authors was used in the research and included 10 major open questions/tasks.

- How do you understand scientific research activity of the students at university? Comment
- Are you interested in scientific research activity? Comment
- What do you think mostly hinders the students to involve (participate) in scientific research activity at university?
- What do you think mostly encourages/motivates students to involve (participate) in scientific research activity at university?
- What importance do you think scientific research activity has for teacher's profession?
- Do you think the study process at university is favourable and promotes to choose scientist (researcher) career in future?
- Please comment how scientific research activity contributes to your professional readiness?
- Comment about your personal preparation to take part in scientific research activity?
- Would you like to have a researcher (scientist) job in future?
- How would you recommend to improve study process, seeking to strengthen/make more effective students' scientific research activity?

The questions cover the basic parameters of scientific research activity such as awareness, interest, interfering and motivating factors, importance to the teacher's profession, a personal level of training, recommendations, etc. The results, obtained based on 1-4 questions, are presented in this article.

Research Sample

Fourth year BA students' pre-service teachers of sciences and some master students from two Lithuanian universities – Siauliai University (38 students) and Lithuanian University of Educational Sciences (46 students) participated in the research. In total, 84 students took part in the research (10 of them male students). The above-mentioned universities are the main institutions training science teachers in Lithuania. According to the study programmes, the respondents were divided as follows: geography (20), biology (18), chemistry (8), health educology (12), kinesiotherapy (12), and bio-education (14).

For the formation of sample, non - probability purposive research group formation method was chosen, when the people included into a research group are the most typical in respect to the researched quality. Referring to Morse (1994), the sample of 30-50 participants

is suitable for such kind of research. On the other hand, basically, there are no strict and specific rules forming the sample for qualitative research. Qualitative sample size may best be determined by the time allotted, resources available, and study objectives (Patton, 1990). Forming the mentioned sample, it was taken into consideration that the respondents are the fourth (final) year bachelor's degree students. The attitude that such sample is sufficiently representative in a qualitative research is maintained.

Data Analysis

Research data were expressed in writing. The obtained respondents' answers were coded. The most frequently repeating semantic units were grouped until the initial groups called sub-categories appeared. In the second stage the sub-categories were combined into categories. The qualitative research data were processed using content analysis, when in the informative array essential characteristics are distinguished. The obtained verbal data array, referring to conventional content analysis methods, was analysed in three stages:

- multiple answer reading;
- semantically related answers and "keywords" are sought;
- semantic unit interpretations.

In order to guarantee data analysis reliability, semantic unit distinction and later on grouping was carried out independently by three researchers. In the later stage, the researchers were looking for a consensus due to sub-category attaching to categories. The coordination degree was higher than 85%.

RESEARCH RESULTS

Having analysed the researchers expressed opinions about student scientific research activity at university, the corresponding categories were distinguished, defining the understanding of the latter (**Table 1**).

The first category "*Active work*" illustrates, that the biggest part of students understand scientific research activity as active work (51.4%), which is usually identified as students' conducted research (36.0%). A small part of students identifies this active work with the conducting of the research together with tutors (7.7%), scientific source studying (6.4%) and participation in scientific events. The obtained results obviously demonstrate, that all scientific research activity steps are reflected in students' understanding what scientific research activity at university is.

The second category "*Compulsory study component*" shows, that a big part of students understand scientific research activity as compulsory study component (30.6%). Here, the students usually identify scientific research activity with final work preparation (20.2%) i.e. course paper, bachelor work preparation, study task completion and so on, with the research, that are related with practice (10.4%). The third category "*Professional improvement*" illustrates, that a small part of students understand scientific research activity as professional

improvement (18.0%), which is related with new knowledge acquisition (12.9%) and its practical application (5.1%).

Table 1. The understanding of student scientific research activity at university.

Categories	N (%)	Subcategories	N (%)	Statements	N (%)
Active work	40 (51.4)	Research conducted by students	28 (36.0)	Research, conducted in different environments, participation in them	8 (10.3)
				Active and independent student activity investigating various problems	6 (7.7)
				Various natural research conducted	5 (6.4)
				Research conducted independently by students, not related with lectures (of their own free will)	3 (3.8)
				Activity related with the research	2 (2.6)
				Student's interest in science	1 (1.3)
				Analysis of various questionnaires	1 (1.3)
				Activity, during which the student investigates a particular type of object	1 (1.3)
				Research, conducted by students, which are interesting for them and useful	1 (1.3)
		Research, carried out together with tutors	6 (7.7)	Research carried out by students with the help of tutors	5 (6.4)
				Student and tutors' carried out activity, having lasting value	1 (1.3)
		Studying of scientific information sources	5 (6.4)	Scientific literature and other source studying, analysing	3 (3.8)
				Novelty, based on theory, search	2 (2.6)
		Participation in scientific events	1 (1.3)	Participation in scientific conferences and seminars	1 (1.3)
Compulsory study component	24 (30.6)	Final work preparation	16 (20.2)	Course paper/or bachelor work preparation	10 (12.5)
				Activity, which is necessary preparing qualification works	3 (3.8)
				Scientific research paper writing	2 (2.6)
				Research, carried out by students on a chosen subject, related with the study programme	1 (1.3)
		Research related with practice	8 (10.4)	Application of students' abilities in practice	2 (2,6)
				Activity which reveals itself through practical students' works	2 (2.6)
				Outdoor practices	2/2.6
				Activity, which requires of applying theoretical knowledge in practice	1 (1.3)
				Various practical tasks, performed by students	1 (1.3)
Professional improvement	14 (18.0)	New knowledge acquisition	10 (12.9)	New knowledge search, systematization, generalisation, documentation	6 (7.7)
				Deepening students' knowledge	2 (2.6)
				Subject competence improvement in a narrow area	1 (1.3)
				Checking of student's accumulated knowledge, a certain competence evaluation	1 (1.3)
		Practical knowledge application	4 (5.1)	Opportunity to conduct experiments, laboratory works, using the acquired knowledge	3 (3.8)
				Ability to apply the knowledge you possess conducting the research	1 (1.3)

Note: *Totally, 78 semantic answers were distinguished.*

Having analysed the respondents' expressed opinions about students' interest in scientific research activity at university, the corresponding categories were distinguished, defining the latter interest in such an activity (**Table 2**).

Table 2. Students' interest in scientific research activity.

Categories	N (%)	Subcategories	N (%)	Statements	N (%)
Obligatory /pragmatic interest	43 (57.3)	Compulsory activity	23 (30.5)	Interested as much as study process requires	8 (10.6)
				Partly interested	8 (10.6)
				Interested as much as it is necessary	6 (8.0)
				Interested according to possibilities	1 (1.3)
		Final work preparation	20 (26.8)	Interested, as much as it is connected with the course paper writing and/or bachelor work preparation	20 (26.8)
Personal/ inner interest	22 (29.4)	Perspective activity	3 (3.9)	Interested, because I want to do such an activity	1 (1.3)
				Yes, I do such activity independently	1 (1.3)
				Take part in such an activity, conduct the research in the laboratory	1 (1.3)
		Interesting activity	19 (25.5)	Yes, interested	12 (16.0)
				Interested, because this is an opportunity to find out new things, to acquire new skills	3 (4.1)
				Interested in such topics, which are interesting	2 (2.7)
				Yes, because it is interesting to get acquainted with various research and to conduct them on one's own	2 (2.7)
Lack of interest in scientific research activity	10 (13.3)	Uninteresting activity	10 (13.3)	Not interested, because this is not actual, uninteresting	10 (13.3)

Note: Totally, 75 semantic answers were distinguished.

The first category "Obligatory/pragmatic interest" illustrates, that most of the students (57.3%) are interested in scientific research activity only because it is a compulsory activity (30.5%), the tasks presented in the study process require this. Final work preparation (26.8%) also encourages students to be pragmatically interested in scientific research activity.

The second category "Personal/inner interest" shows, that a third of students (29.4%) are interested in scientific research activity not only because study process requires this, but because this is an interesting activity (25.5%) and a perspective activity (3.9%) for them. These students point out, that they are interested in scientific research activity and want to do this activity, they note, that this is a possibility to find out new things, to acquire new skills.

The third category "Lack of interest in scientific research activity" shows, that for part of the students (13.3%) scientific research activity is uninteresting, not actual. Having analysed the factors, limiting students to involve in scientific research activity, the corresponding categories were distinguished (**Table 3**).

Table 3. Factors, limiting students to involve (participate) in scientific research activity at university

Categories	N (%)	Subcategories	N (%)	Statements	N (%)
Lack of motivation	44 (42.2)	Indifference	32 (30.8)	Lack of motivation	20 (19.4)
				Just other interests	7 (6.6)
				Students' apathy, lack of interest	5 (4.8)
		Unwillingness to improve	12 (11.4)	Unwillingness to learn, laziness	5 (4.8)
				Student unwillingness to improve	4 (3.8)
				Lack of competence	3 (2.8)
Study process and content gaps	43 (40.7)	Poor tutors' help	19 (18.0)	Lack of encouragement and motivation from tutors	12 (11.4)
				Tutor passiveness and unwillingness	2 (1.9)
				Poor university community enthusiasm	2 (1.9)
				Poor orientation to such an activity during the lectures	2 (1.9)
				There are no possibilities to involve	1 (0.9)
		Big study workload	12 (11.3)	Student occupation in everyday activity	10 (9.5)
				Big learning workload	1 (0.9)
				Tense lecture time	1 (0.9)
		Lack of information	10 (9.5)	Lack of information about such an activity	10 (9.5)
		Lack of resources	2 (1.9)	Lack of equipment and devices	2 (1.9)
Big occupation	18 (17.1)	Lack of time	14 (13.3)	Time shortage	12 (11.4)
				This requires additional time	2 (1.9)
		Work	4 (3.8)	Work, because students usually work	4 (3.8)

Note: Totally, 105 semantic answers were distinguished.

The first category "*Lack of motivation*" shows, that for a big part of students (42.2%), internal factors interfere with involvement in scientific research activity. The subcategory "Indifference" occupies the biggest part in this category (32.8%), "Unwillingness to improve" – a smaller one (11. 4%).

The second category "*Study process and content gaps*" (40.70%) identifies external factors, hindering the students to participate in scientific research activity. The biggest part of students point out, that poor tutors' help (18.0%) and big study workload (11.3%) hinder to involve in active scientific research activity. Quite a small part of students identified a lack of information (9.5%).

The third category "*Big occupation*" also identifies external factors, hindering students to involve in scientific research activity. Here, students most often identify time shortage and work that they have after the lectures.

Students' lack of motivation to participate in scientific research activity is a matter of a big concern. It is obvious, that it is much more difficult to adjust internal factors, limiting students to involve in scientific research activity than the external ones.

Having analysed the factors, promoting students to involve in scientific research activity, the corresponding categories were distinguished (**Table 4**).

The first category "*Study process environment*" allows stating, that favourable study process environment at university promotes the biggest part of students (43.3%) to involve in scientific research activity. The great majority of students (26.4%) indicate tutor support as the main factor, encouraging to participate in scientific research activity. Tutor approval, engagement, support, moral support and so on, are important for students. It is obvious, that a tutor is the main example and authority for students in scientific research activity, therefore his opinion for them is important, his accumulated experience and carried out scientific research impress them. Involvement in interesting activity i.e., actual, useful topics analysed in the study process, interest in study subjects, interesting and involving lectures, promote (15.8%) of students to participate in scientific research activity.

The second category "*Professional interest*" allows asserting, that a desire to prepare well for professional career promotes a lot of students (40.8%) to involve in scientific research activity. A great part of students point out, that personal/professional improvement need (20.4%), future prospect understanding (13.6%), practical application (6.8%) encourage them to participate in scientific research activity.

The third category "*Pragmatic interest*" allows asserting, that study process content and personal needs encourage a part of students (15.9%), to participate in scientific research activity. Here, evaluation need (4.5%) i.e., high evaluation, acknowledgement are important for students. Final work preparation (8.0%) i.e., desire to better prepare works, get higher evaluation and so on, promote students to participate in scientific research activity.

Table 4. Factors, promoting students to involve (participate) in scientific research activity at university.

Categories	N (%)	Subcategories	N (%)	Statements	N (%)
Study process environment	38 (43.3)	Tutor support	23 (26.4)	Tutors, their approval, support	20 (23.0)
				Moral support	2 (2.3)
				People, capable to engage in such an activity	1 (1.1)
		Involvement in interesting activity	14 (15.8)	Interesting, urgent and useful topics	8 (9.0)
				Interest in particular subjects	2 (2.3)
				Interesting research works	1 (1.1)
				Interesting, involving lectures and seminars of the tutors	1 (1.1)
				Student activity	2 (2.3)
		Proper condition formation	1 (1.1)	Proper conditions for research activity	1 (1.1)
Professional interest	36 (40.8)	Personal/professional improvement	18 (20.4)	Desire to cognise, to acquire more knowledge, curiosity	12 (13.6)
				Desire to improve	3 (3.4)
				Desire to improve the skills you possess	2 (2.3)
				Desire to achieve more	19 (1.1)
		Future prospect understanding	12 (13.6)	Possible benefit both now and in the future	5 (5.7)
				Personal interests	4 (4.5)
				Future prospects, seeing them	2 (2.3)
				Joy of discovery	1 (1.1)
		Practical application	6 (6.8)	Experience acquisition	4 (4.5)
				Possibilities to apply research results in practice	2 (2.3)
Pragmatic interest	14 (15.9)	Evaluation need	7 (8.0)	Higher evaluations	5 (5.7)
				Acknowledgement aim	2 (2.3)
		Final work preparation	4 (4.5)	Final work preparation	3 (3.4)
				Desire to better prepare final works	1 (1.1)
		Material interest	3 (3.4)	Grants	2 (2.3)
				Promotion	1 (1.1)

Note: *Totally, 88 semantic answers were distinguished.*

DISCUSSION

It is obvious, that student scientific research activity (SRA) is a very significant component of the university studies. Latterly it is especially accentuated, that a teacher in the study process and in the educational practice has to develop scientific research activity and to become a teacher-researcher. Changing pedagogue's activity requires from him research activity

competencies. Teacher researcher is a practitioner constantly reflecting on his activity, organizing pedagogical activity research, applying various research methods. Today, research activity is understood as the basis of teacher profession, affecting education process quality and encouraging everyday practical activity merge with teaching and learning (Hargreaves, 1999, 2008).

Such activity is as a connecting link between teaching and research activity, according to M. Healey (2005) linking research and teaching. The obtained research results show, that a third of students treat such an activity as a compulsory study component and only 18% as a professional development. A similar part, i.e. a third of students assert, that such activity interests them, they are inclined to do it. About 60% of students assert that they do this activity only based on pragmatic interest, because study process requires this, e.g., final qualification work preparation. In this respect, tutor encouragement, causing interest and involvement in scientific research activity is very important. It is important to encourage faculty members to mentor students through research experiences (Eagan, Sharkness, Hurtado, Mosqueda, Chang, 2011). On the other hand, it is important to encourage students to take advantage of different research opportunities. As the carried research showed, over 40% of students lack motivation, besides, help and support from the teachers is not sufficient. Analysing factors promoting involvement and participation in SRA, it can be seen, that suitable study environment and especially tutors' support are of crucial importance. One has to agree with the other researchers' position, that it is very important to include students in such an activity from the first study years at university. As the researchers emphasize, early efforts are necessary to acquaint and direct students toward research careers (Hurtado, Eagan, Cabrera, Lin, Park, Lopez, 2008), on the other hand, students learn and are assessed in ways that come as close as possible to the experience of academic staff carrying out their disciplinary research (Healey, Jenkins, 2009).

The research results allow discerning certain links between students' interest in scientific research activity and factors hindering and promoting the students to involve (participate) in scientific research activity. The answers of the biggest part of students (57.3%) show that their interest in scientific research activity is obligatory (pragmatic), also, the majority of students' (42.2%) answers allow asserting, that lack of motivation (indifference, unwillingness to improve) hinders them to participate in scientific research activity, and promoting factors to participate in scientific research activity are related to study process environment (43.3%). It is obvious, that obligatory/pragmatic interest in scientific research activity does not promote inner motivation and external factors become important for students (tutor support, involvement in activity, proper condition forming), which encourage them to be interested in scientific research activity. On the other hand, one can think, that the defined external factors promote students to be interested and participate in scientific research activity and form inner motivation for this activity. Even more, that the factors, indicated by a big part of students (40.7%), hindering to involve (participate) in scientific research activity (going after lack of motivation –42.2%) are related with study

process and content drawbacks (poor tutors' help, big study load, lack of information, lack of resources). 29.4% of student answers allow asserting, that they participate in scientific research activity due to personal/inner interests (perspective activity, interesting activity), however only 3.9% of students indicate, that this is a perspective activity. This allows making a hypothetical assumption, that few students relate their professional career with scientist's career.

CONCLUSIONS

During the research it has been stated, that the major part of students understand scientific research activity at university as active work during which students independently and together with the tutors conduct the research, study scientific literature, participate in scientific events. A third of students understand scientific research activity at university as a compulsory study process and content component, understanding this activity as final work preparation, the research performed during the practices. A small part of students understand scientific research activity at university as professional improvement relating this understanding with new knowledge acquisition, practical knowledge application.

Analysing student expressed opinions about interest in scientific research activity at university it has been stated, that interest of the greater part of students is obligatory/pragmatic, i.e. students are interested in scientific research activity because this activity is compulsory in the study process, it is necessary to prepare final works, to perform various tasks. Interest of one third of students in scientific research activity can be related with personal/inner interest, because this activity seems to be perspective and interesting for these students. A small part of students assert, that they are not interested in scientific research activity, it is not interesting, not actual for them.

Analysing student identified factors, limiting them to involve (participate) in scientific research activity, it has been revealed, that the greater part of students relate this with lack of motivation, accentuating student indifference to this activity, unwillingness to improve. The opinion about the factors, hindering to involve in scientific research activity, expressed by a similar part of students allows stating, that study process and content gaps: poor tutor support, big study workload, lack of information determine this.

Analysing the factors, which promote the students to involve (participate) in scientific research activity, one can state that more than half of the students relate this with the favourable study process environment, in which tutor support, involvement in interesting activity (interesting, actual topics, involving tutor lectures, interesting research and so on), proper condition formation are important. Almost the same number of students assert, that professional interest: personal/professional improvement, future prospect understanding, practical application promote participation in scientific research activity. A small part of students indicate the factors related with pragmatic interests: need to be evaluated,

acknowledged, final work preparation, material interest promote them to participate in scientific research activity.

NOTE

This paper was presented at the XVIIth IOSTE International Symposium 'Science and Technology Education for a Peaceful and Equitable World', 11-16 July 2016, Braga, Potugal. It was approved by the Symposium scientific committee and recommended for publication.

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