RESEARCH ARTICLE

Visiting professor program for environmental science: Does it contribute to student learning experience and problem-solving skills?

Anggi Tias Pratama [a,1,*], Rizqa Devi Anazifa [a2], Nurul Bahiyah Abd Wahid [b,3]

[a] Department of Biology Education, Faculty of Mathematics and Natural Science, Universitas Negeri Yogyakarta, Jl. Colombo Yogyakarta No.1, Karang Malang, Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia

[b] Department of Biology, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjung Malim, Perak, Malaysia

[1]anggitias@uny.ac.id*; [2]rizqa1992@uny.ac.id; [3]nurul_bahiyah@fsmt.upsi.edu.my

Abstract: This study reveals the contribution of student learning experiences and problem-solving skills in the Visiting Professor (VP) program. This research includes the type of ex post facto correlational research. The data collected in this study were learning experiences and problem-solving skills. Data collection techniques used a questionnaire to find out students' learning experiences on environmental change material, written essay tests to determine the ability to solve environmental pollution problems, and interviews with students on environmental change material. The results of this study found that the VP program had a relationship with and contributed to students' learning experiences and problem solving. The experience of the learning model in this VP gives the greatest contribution to problem-solving skills, followed by indicators of learning models based on student perceptions with percentages, indicators of learning resources with percentages, indicators of direct experience with percentages, indicators of substitute experience with percentages, and the last indicator that has a contribution the smallest is the indicator of student interaction with the percentage. The VP program should be carried out every semester in environmental science courses so that students get learning experience and problem solving. The next research that will be carried out is to look for other factors that influence and contribute to the VP program.

Keywords: Environmental science; problem-solving skills; student learning experience; VP program

For correspondence:
anggitias@uny.ac.id

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Introduction

The national development agenda set forth in the Technocratic Draft National Medium-Term Development Plan IV (RPJMN IV) for 2020-2024 is to Improve Qualified and Competitive Human Resources (BAPPENAS, 2019). Human resources in question are human resources who have skills and skills in meeting development needs; Healthy human resources are smart, adaptive, innovative and have character. In addition, future development is also directed at encouraging the growth of science and technology that is qualified in development, both in natural resource management, governance and decision-making.

The development of science and technology in the Industrial Revolution 4.0 era, where Information and Communication Technology (ICT) and artificial intelligence have been able to influence and dominate almost all aspects of human life including education in universities. Advances in the fields of engineering and ICT also continue to generate surges in needs and ideas that lead to an era full of uncertainty (an

era of disruption). In this era of uncertainty, there are changes that are very fast and often unpredictable regarding human thoughts and needs. The rapid changes and uncertainties that characterize the era of the early 21st century also concern the fields of business and career. In this era, new fields of work and careers emerged that were completely unthinkable a few years ago. In other words, existing work and career fields which are viewed systematically at this time, may change or even disappear in the next few years. After graduating from university, students must live in a dynamic, flexible, and often unstructured work environment with rapidly developing information technology (Payne, 2019). To face this era, students need to be equipped with the readiness of relevant learning experiences and competencies, for the success of their own lives when later living in society or when working as teachers.

Student learning activities can be built through the accommodation of various learning experiences that have been obtained. Learning experiences are a number of student activities carried out to obtain new information and competencies in accordance with the goals to be achieved (Megawati, 2018). The learning experience is closely related to the development of students' process skills. Science process skills are important for students to have because they can make students understand the subject matter better (Oktaviastuti, 2014). Science process skills can also enable students to learn to find science facts and concepts through real experiences (Putra, 2022). Science process skills are still a separate problem for the teaching and learning process in tertiary institutions because their achievements are still low. Science process skills in schools are in fact still not fully realized in biology learning. Science process skills can be trained by means of students gaining direct experience during the learning process (Siahaan et.al, 2017). Learning methods that do not develop science process skills can be one of the causes of low science process skills in students.

Environmental science is a broad and multidisciplinary science that involves the study of the natural resources of land, water and air. Introduction to Environmental Science comprehensively covers many aspects of this broad subject. This course is implemented in line with the Industrial Revolution 4.0 era and supports the achievement of 21st century skills, especially critical thinking, creative thinking, and problem-solving skills. Ruzek and Schenke's (2019) study show that cooperative and interactive learning strategies contribute to the promotion of higher order thinking for both students. The use of various teaching strategies and pedagogical approaches can address the diversity of learning styles and stages of student development, as well as enhance the formation of problem-solving concepts (Casinillo & Guarte, 2018; Ma, 2003).

According to Subiantoro (2016) through accommodating student learning experiences can develop student competence in exploring and solving natural problems scientifically. Learning experiences are very important to be given to students so that their learning is more meaningful, both in the learning process and in the learning outcomes obtained by students (Megawati, 2018). Learning experience will affect learning outcomes because the learning experience that has been owned will be used to connect lessons that are known with the knowledge that will be learned (Gunawan, 2021).

One of the efforts to accommodate student learning experiences is the Visiting Professor (VP) program activities. The VP program aims to support academic activities in developing international insights for students. VP has a very important role to play as a vehicle for adding new insights for lecturers and students which are developed according to the needs and developments of the times. The research results of Mills et al (2014) examined the effectiveness of VP programs organized by two countries (China and Canada) from the perspective of lecturers and staff. Mikalef et al (2018) examined the effectiveness of the VP program from the perspective of lecturers and students in Norway. Visiting professor activities in Indonesia provide benefits to improve the quality of student education, namely to improve lecturers' scientific writing skills. This collaboration can also build international academic cooperative relations.

Universitas Negeri Yogyakarta (UNY) towards a World Class University of Education (WCUE) can provide support for the development of an international outlook to all UNY academics. One form of this support is by providing opportunities for UNY lecturers to participate in academic activities in the form of VP (outbound) as well as inviting professors from universities or research institutions abroad (inbound). Visiting professor (inbound) activities are held in the form of lectures, workshops, or other academic activities delivered by foreign professors with student participants, and lecturers (faculties, departments, program organizers), as well as students and lecturers from across faculties, majors, and study programs at the University (Irina et al., 2017). This study aims to look at that area. Thus, a research question is asked whether the VP program contributes to student experience and problem solving in environmental science courses.

Method

Research design

This research includes the type of ex post facto correlational research. Correlational research (relationship) is research that aims to find out whether there is a relationship between two or more variables and how much correlation exists between the variables studied (Ibrahim et.al, 2018; Jack and

Norman, 2019). Ex post facto research is collecting data based on past events and then reflecting on the present. This study uses a quantitative data analysis approach. Quantitative data is data presented in the form of numbers/numbers from the results of calculations and measurements (Darwin et.al, 2020).

Context and participants

This study used undergraduate students taking environmental science courses at the Department of Biology, UNY in 2022. The sample size for VP participants in the course was 68 people from a 200 population. The VP of environmental science brought in a Professor from Universiti Pendidikan Sultan Idris (UPSI) Malaysia. Lecture activities through VP discuss the principles of environmental change, environmental pollution and environmental change. The number of VP meetings in lectures was carried out for 8 meetings (8 weeks) and lecture activities were carried out using lecture, question and answer, discussion, and evaluation methods.

Data sources

Sources of data in this study include: learning experiences and students' problem-solving skills. Data collection techniques in this study used three methods, namely a questionnaire (questionnaire) to find out students' learning experiences on environmental change material, written essay tests to determine the ability to solve environmental pollution problems, and interviews with students on environmental change material (Widoyoko, 2016). The researcher gave a questionnaire consisting of five indicators, namely student interaction, learning resources, student experience (direct and substitute), and the implementation of scientific learning models on environmental change material. The problem-solving ability test in this study used a description test regarding environmental pollution material. The problem-solving ability description test consists of three main topics, namely water pollution, air pollution, and soil pollution. And the type of interview used in this study is a structured interview.

Data analyses

All quantitative data were analyzed by researchers. Researchers analyze descriptions by describing or giving an overview of the object under study: as it is without drawing conclusions or generalizations. In this descriptive statistics, ways of presenting data are presented in the form of tables and diagrams, determining the average (mean), mode, median, range and standard deviation (Nuryadi et.al, 2017). Analysis of research activity data that aims to answer questions, prove hypotheses, and explain the phenomena that form the research background (Garaika, 2019). Data analysis in this study used regression analysis to find out the correlation regression equation between learning experience and problem solving. In addition, this research reveals the contribution of each learning experience and problem solving (Gravetter & Wallnau, 2013).

Results and Discussion

The results of the research description based on learning experience and problem-solving skills can be seen in Table 1 and Table 2.

Table 1. Analysis of the description of learning experiences

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Learning experiences	68	96	60	156	7292	108.84	2.599	21.272	452.503	.012	.293	-.568	.578
Valid N (listwise)	68												

Table 2. Analysis of the interview ability description

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Problem-solving skills	67	34	20	54	2500	37.31	.807	6.606	43.643	-.223	.293	.011	.578
Valid N (listwise)	67												

The results of the correlation regression analysis between learning experiences and student problem solving can be seen in Table 3 and Table 4.

Table 3. Correlation analysis of Pearson product moment learning experience with problem solving ability

Correlations

		Learning experience	Problem-solving skills
Learning experience	Pearson Correlation	1	.249*
	Sig. (2-tailed)		.043
	N	68	68
Problem-solving skills	Pearson Correlation	.249*	1
	Sig. (2-tailed)	.043	
	N	68	68

*. Correlation is significant at the 0.05 level (2-tailed).

Based on the results of the analysis in table 3, the Pearson Product Moment correlation analysis obtained a significance value of 0.043. The significance value is less than 0.05 so that it can be stated that there is a significant relationship between the learning experience of environmental change materials and the ability to solve environmental pollution problems. The correlation coefficient on the test results is 0.249 and shows a positive value. This positive value means that there is a positive relationship between learning experience and students' problem-solving skills. This positive relationship means that the higher the level of learning experience, the higher the level of problem-solving skills in students.

Table 4. R square test of learning experience on problem-solving skills

Model Summary

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.249[a]	.063	.047	6.448

a. Predictors: (Constant), Learning experience

Based on the results of the analysis in table 4, the value of the determinant coefficient can be used to determine the size of the contribution of learning experience to problem solving skills. The coefficient value obtained is 0.063 or 6.3%. This value indicates that the contribution of learning experience is only 6.3% and the remaining 93.7% is donated by other factors not tested in the study.
The results of the R Square test are reviewed based on each indicator of the learning experience of environmental change material which can be seen in Table 5, Table 6, Table 7, Table 8, Table 9, and Table 10.

Table 5. R square test of student interaction indicators on problem-solving skills

Model summary[b]

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.110[a]	.014	-.003	6.616

a. Predictors: (Constant), student interaction

b. Dependent Variable: problem-solving skills

Table 6. R square test indicators of learning resources on problem-solving skills

Model summary[b]

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.182[a]	.034	.018	6.546

a. Predictors: (Constant), learning resources

b. Dependent Variable: problem solving skills

Table 7. R square test indicators of direct experience on problem-solving skills

Model Summary[b]

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.163[a]	.028	.012	6.568

a. Predictors: (Constant), direct experience

b. Dependent Variable: problem solving skills

Table 8. R square test of substitute experience indicators on problem-solving skills

Model summary[b]				
Model	R	R square	Adjusted R square	Std. error of the estimate
1	.147[a]	.023	.007	6.584

a. Predictors: (Constant), replacement experience

b. Dependent Variable: problem-solving skills

Table 9. R square test indicators of implementability of the scientific learning model applied to problem-solving skills

Model summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.092	.077	6.346

a. Predictors: (Constant), learning models' syntax

b. Dependent Variable: problem-solving skills

Table 10. R square test indicators of learning models based on students' perceptions of problem-solving skills

Model summary[b]				
Model	R	R Square	Adjusted R square	Std. error of the estimate
1	.280[a]	.078	.064	6.390

a. Predictors: (Constant), learning models-based students' perception

b. Dependent Variable: problem solving skills

Based on the results of the analysis of tables 5 to 10, it was found that the contribution of learning experience indicators to problem solving skills was the greatest, namely the implementation of the applied scientific learning model with a percentage of 9.2% followed by indicators of learning models based on student perceptions with a percentage of 7.8%, sources indicators learning with a percentage of 3.4%, an indicator of direct experience with a percentage of 2.7%, an indicator of substitute experience with a percentage of 2.4%, and the last indicator that has the smallest contribution, namely an indicator of student interaction with a percentage of 1.2%.

The learning experience can be influenced by several things, the first is that it can be influenced by the learner's interactions with external conditions (Ammigan & Jones, 2018). The teaching and learning process will take place well if there is a good relationship between the teacher and students (Iswardhany, 2016). It is hoped that the process of social interaction at school will make students confident, able to communicate effectively, respect each other, and be able to achieve good learning achievements (Fitri, 2021). Furthermore, Ammigan (2019) found that student satisfaction is obtained through learning experiences with direct experiential learning.

Wiers-Jenssen et.al (2002) and Sahin (2014) found teaching quality, among other factors, to be an important determinant of student satisfaction. The relationship between student satisfaction and educational offerings at higher education institutions was also examined by Butt and Rehman (2010), who found that teacher expertise, quality of programs offered, learning resources, learning environment, and classroom facilities all increase satisfaction. Asare-Nuamah (2017) concluded that library services, teacher contacts, class sizes, course content, reading materials, and general administration services are keys to enhancing the student experience.

Substitute experiences using ICT contribute to learning. This is in line with what was found (Gajjar, 2013; Ghorbanzadeh et al., 2019) that learning experiences provide different satisfactions in the classroom. Problem solving can be done by having learning experiences through VP by lecturers from outside the country and conceptually. The available literature is limited on student satisfaction and learning is mostly focused on domestic students taught by visiting lecturers (García-Aracil, 2009).

Responses to the results of interviews with students

Based on the results of student interviews with regard to various indicators of learning experience and problem-solving skills are presented in the following: (1) Student interaction. During learning, there is good interaction between students and teachers and between students through question-and-answer activities, discussions, and presentations. (2) Learning resources. The learning resources used are materials equipped with pictures and important points using PowerPoint media, textbooks (limited), sources from the internet (self-searching), and videos regarding waste recycling. (3) Direct experience. Direct experience related to the environment is obtained outside of learning hours in school activities, namely environmental crises. Environmental Krida consists of several series of activities, namely engine off, sorting waste, planting plants, and cleaning the school environment. (4) Substitute experience. The

learning process is more often carried out using the question-and-answer method, explanations from the teacher, presentations from students, and reading several sources to collect the information sought. Thus, substitute experience in learning is more often through words, namely by listening and reading. (5) Scientific Learning Model. The learning models used are two learning models Project Based Learning and Discovery Learning. (7) Problem solving skill. Lecturers always ask questions at the beginning of learning to raise a problem and in groups solve these problems by discussing. In addition, the teacher also always relates to problems that are close to students and occur in everyday life.

Teaching and assessment factors appear to play a large role in student learning. In courses that apply active teaching and learning activities, almost all students describe adopting an in-depth approach (McEnroe-Petitte & Farris, 2020). It appears that teaching that provides sufficient challenge to students requires active involvement of students throughout the course, providing opportunities for peer support, and using high-quality teaching materials to support students adopting deep learning (Li et al., 2022). In this learning environment, students can acquire basic content knowledge to work on problem sets and engage with class activities. Students actively engage in interactive sessions for in-class assignments followed by face-to-face instruction, they can build high-level cognitive skills and engage in meaningful learning (Lu et al., 2021). Meaningful learning uses interesting learning resources. All objects and the surrounding environment can be used as learning resources.

Conclusion

In conclusion, in this study, the VP program contributed little to the learning experience and problem solving of biology students. They can add experience from the VP process to be able to solve environmental problems. Lectures in class can and outside class based on important points.

The VP program is well implemented at universities, because it can enhance and contribute to learning experiences and problem-solving skills. This program can be carried out every semester in environmental science courses. The learning experience that students get is not only from within the country, but experience comes from foreign guest lecturers.

Limitations and Future Directions

Some limitations in this study. First, this study only used a small sample in the environmental science class and could not be used in other classes. Both of these studies only measure the contribution of learning experiences and problem solving. And finally, the third, there are other factors that have not been revealed in this study that contribute to learning experiences and problem solving. Future studies can look for other factors that can contribute to the learning experience and problem solving in the VP program.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

A. T. Pratama: writing original draft preparation, Analyis and validation; **R. D. Anazifa:** methodology, instrument and review. **N. B. Abd Wahid: r**eview, executor, and lecture.

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