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# DEVELOPMENT OF WEB BASED SELF ASSESSMENT AND ENVIRONMENTAL PROBLEM SOLVING TEST FOR GEO INQUIRY BASED COMMUNITY SERVICE LEARNING MODEL

**RIMA MEILITA SARI [1]*, TUTI MUTIA [2], RIDHWAN [3], TENGKU MUHAMMAD SAHUDRA [4] and FAIZ URFAN [5]**

[1] Geography Education Program, Faculty of Teacher Training and Education, Universitas Samudra, Langsa, Indonesia. Jalan Prof. Dr. Syarief Thayeb, Meurandeh, Langsa Lama, Langsa, Aceh, Indonesia.
*Corresponding Author Email: rima.melita.sari@unsam.ac.id
[2] Department of Geography, Faculty of Social Science, Universitas Negeri Malang, Malang, Indonesia.
[3] Geography Education Program, STKIP Al-Washliyah, Banda Aceh, Indonesia.
[4, 5] Geography Education Program, Faculty of Teacher Training and Education, Universitas Samudra, Langsa, Indonesia.

**Abstract**

Geo-Inquiry-based Community Service Learning is a learning model designed to increase higher-order thinking skills through a scientific process by carrying out community service activities. To carry out this learning, it is necessary to assess self-directed learning and environmental problem-solving ability. This article aims to develop a web-based self-assessment and environmental problem-solving ability test to accommodate geo inquiry community service activities. The self-regulated learning instrument refers to the self-directed learning indicator from Shen et al, while the environmental problem-solving ability instrument refers to the Sanjaya indicator. The instrument was validated by learning and material experts. Furthermore, the test results produce a score of validity and reliability. The results showed that the test was successfully developed with the self-directed learning test having a validity score of 0.547 – 0,967 and a reliability of 0.547. The environmental problem-solving ability test obtained a validity value of 0.517 – 0,870 and a reliability value of 0.867. Based on the results of the development, the test instrument is ready to be used to assess elf directed learning and environmental problem-solving ability. The test has also been able to support Geo-Inquiry based Community Service Learning model

**Keywords:** Test development Web-based Self-Assessment Test Web-based Environmental Problem-Solving Test Geo-Inquiry Learning Geo-Inquiry Based Community Service Learning

## 1. INTRODUCTION

Geo inquiry based community service learning aims at interacting, interpreting and analyzing spatial and environmental patterns with implementing inquiry learning models integrating with community services. Geography teacher plays a role in facilitating this learning. What is prepared by the teacher are teaching materials, learning media, and locations that support inquiry learning activities based on community service [1]. However, one thing that must be developed by the teacher is related to evaluation and reflection materials. The purpose of the evaluation is to determine the achievement of learning outcomes [2].

The focus of learning outcomes in world universities now leads to developing students' self-directed learning. This ability is related to the ability to learn throughout life. Especially in the demanding digital era that makes information dissemination easily throughout the world.

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Making the information is not limited by space and time. Therefore, the process of forming students to become independent learners is the main focus of researchers in today's world [3].

Learning success is not measured by cognitive and skills alone but can be measured by attitude. One of the attitude competencies that is least paid attention to is independent learning, even though this competency is very important. Independent learning is an aspect for success in learning and increasing achievement [4]. here are several indicators that can be seen if a person has high self-directed learning, including being able to think critically, creatively and innovatively, and has a level of problem solving by thinking deeply [5], [6].

Problem solving abilities are also a focus in research activities around the world. This ability gives students sensitivity to environmental conditions and skills in providing applicable solutions to learning. Various studies examine the importance of problem solving learning in the field of Education by developing models, mobile-based learning technologies in environmental learning, and ecological approaches to learning to overcome environmental degradation in the 21st century, which are carried out at various levels of Education [7]–[10]. His article aims to develop an evaluation tool to measure self-directed learning and problem solving abilities to support geo inquiry based community service learning.

## 2. METHOD

This research was implemented on the younger generation with two variables being tested, namely self-directed learning and environmental problem solving abilities. For the basis of the answers of self-learning ability, problem-solving ability, we developed a test instrument to test self-learning ability and problem-solving ability. This research was divided into three stages to produce a web-based assessment tool to test self-directed learning and problem solving abilities.

### 2.1 Developing a Conceptual Framework

The stages are determining definitions, the conceptual framework that underlies the assessment instrument for independent learning and environmental problem-solving abilities, the features of the independent learning tests and tests for environmental problem-solving abilities by studying the theories and ideas of the variable instruments developed.

### 2.2 Develop SDLI and EPSI Online Assessment Systems

This phase 2 stage makes innovations that are designed and developed in research. An expert validation study was conducted over two rounds. Two experts namely learning experts in tertiary institutions and environmental education experts were invited to participate in the instrument evaluation assessment. Each expert was asked to assess each SDLI and EPSI item according to their expertise and research experience regarding the item being assessed. The expert assesses suitability (question items can measure SDL and EPS in the younger generation), representativeness (items express precisely the core concepts of SDL and PSI), understanding (items reveal the ease of interpretation of SDLI and EPSI) and explicit (SDLI and EPSI items clearly describe and easy to understand). The expert's assessment uses a 4-

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point Likert scale (1= irrelevant and should be deleted; 2= seems relevant; 3= relevant but needs a little revision; and 4= very relevant, precise and clear to measure SDL and EPS). Items with a mean score ≥ 3.0 were retained. Items with a score ≤ 3.0 are deleted. The decision for revision is made based on expert opinion.

### 2.3 Testing Instrument Factors

The structure of the instrument that has been validated is then tested with the validity and reliability of the instrument. This is to assess the structure of the instrument and the consistency of the instrument. Two scientific fields, namely natural sciences and social sciences (third, fifth, and seventh years) participated in this study. A total of 48 students with regular lectures were recruited to be involved in research. The students who were involved did not see gender and other demographic backgrounds. However, this study was dominated by female students (80% female). The age range of students involved is 19-23 years. Validity and reliability test using statistical analysis with SPSS 23 for Windows software.

## 3. RESULTS AND DISCUSSION

### 3.1 Developing a Conceptual Framework

In the first stage of the SDLI and EPSI development activities, the researchers conducted a content review of the various SDLI and EPSI instruments. SDLI refers to the measurement instrument from Shen et al. [11] [12] and EPSI refer to the measurement instruments from [10] he selection of SDLI and EPSI instruments is due to the characteristics of students in Indonesia. The SDLI indicators are learning motivation, planning, self-monitoring, and intrapersonal communication. The indicators from EPSI are formulating the problem, formulating hypotheses, collecting data, testing the hypotheses, providing problem solving recommendations.

### 3.2 Develop SDLI and EPSI Online Assessment Systems

Phase II begins with compiling the SDLI and EPSI instruments. We developed a website that contains student self-directed learning tests and environmental problem solving https://ruangbelajarmandiri.com/. The website that we provide contains teaching materials and case studies as material for discussion and learning materials to provide initial cases as a stimulus for student self-directed learning. This website requires a student identification number and account registration to be able to access it.

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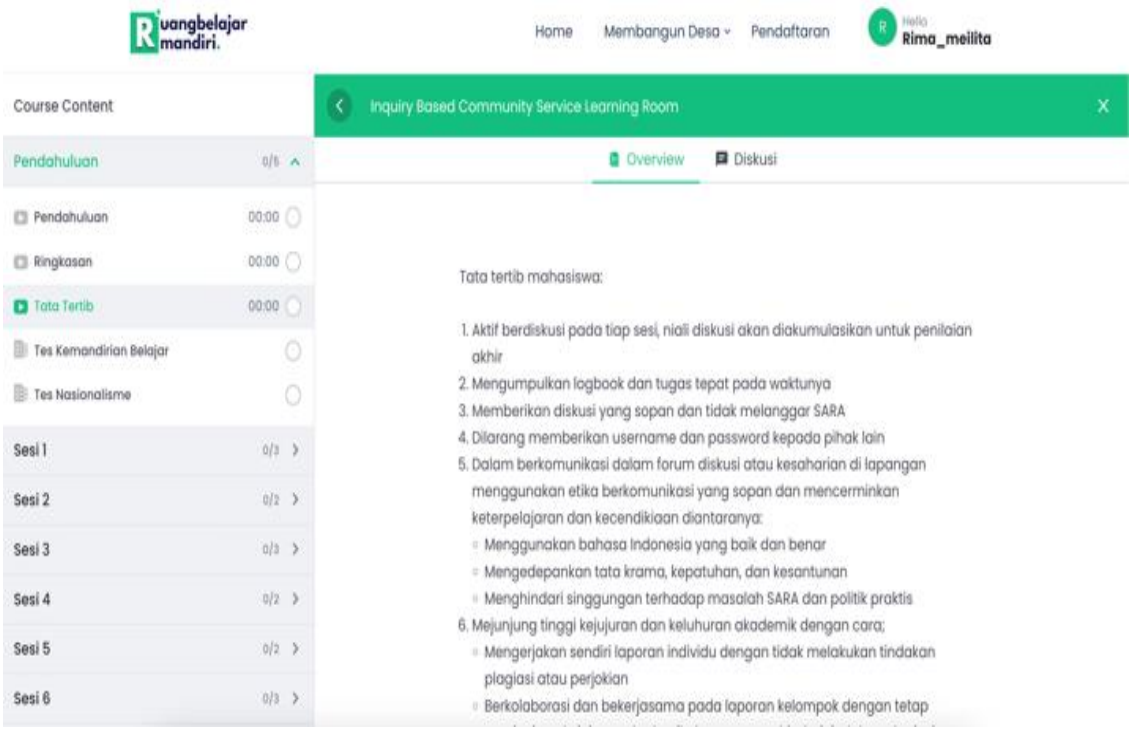


**Figure 1: Web-Based Self-Assessment and Environmental Problem-Solving Test**

At SDLI we compiled an initial instrument of 30 items. After the Delphi study which was conducted in two rounds, the instrument became 28 items. In the first round, 2 question items were deleted on 4 indicators because they have the same meaning as other question items. An expert recommended modifying the research items on self-monitoring indicators on the grounds that the sentences on the questionnaire were too difficult for students to understand. Then the advice from experts in the second round shows that it is necessary to add question items related to the ability to communicate with others, on the grounds that the ability to communicate with others is an important skill to be able to support independent learning.

In EPSI, 20 items were arranged as instruments. After conducting the Delphi study, the instrument consisted of 15 items with five indicators. In the first round the instrument is reduced to 5 items. This is due to the meaning of bias and the combination of several questions because they are not in accordance with the indicators to be reviewed. In the second round, the expert suggested that the instrument should be equipped with cases that lead to contextual problems that occur in the environment. For this reason, the expert suggests the case of "flood problems in Aceh Tamiang District". The results of the revision of expert advice were then tested for validity and reliability.

### 3.3 Testing Instrument Factors

SDLI on 28 items were tested with validity and reliability tests. In SDLI, there are 20 valid instruments with a range of 0.547 – 0.967. The results of the reliability test produce reliable instruments with cronbach's alpha values > r table (0.547 > 0.2845)

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EPSI a number of 15 items tested. The final results show that 5 items were omitted because they were invalid so that the final round of the test produced 10 test items. The results of the validity test show the validity of the items with a range of 0.517 - 0.870. The reliability score indicates the reliability of the test items with Cronbach's alpha values > r table (0.867 > 0.2845). The detailed results of the validity and reliability calculations can be seen in Table 1.

**Table 1: Validity Result for SDLI and EPSI**

| SDLI | Validity | EPSI | Validity |
|---|---|---|---|
| Learning Motivation (LM)_1 | 0,640 | Formulating the Problem (FP) | 0,572 |
| LM_2 | 0,785 | Formulating Hypotheses (FH)_1 | 0,870 |
| LM_3 | 0,831 | FH_2 | 0,677 |
| LM_4 | 0,656 | FH_3 | 0,780 |
| LM_5 | 0,922 | Collecting Data (CD) | 0,738 |
| LM_6 | 0,547 | Testing the Hypotheses (TH)_1 | 0,703 |
| Planing and Implementing (PI)_1 | 0,934 | TH_2 | 0,677 |
| PI_2 | 0,949 | TH_3 | 0,730 |
| PI_3 | 0,750 | Providing Problem Solving Recommendation (PPSR)_1 | 0,565 |
| PI_4 | 0,949 | PPSR_2 | 0,517 |
| PI_5 | 0,839 | | |
| PI_6 | 0,640 | | |
| Self-Monitoring (SM)_1 | 0,804 | | |
| SM_2 | 0,813 | | |
| SM_3 | 0,771 | | |
| SM_4 | 0,740 | | |
| Interpersonal Communication (IC)_1 | 0,967 | | |
| IC_2 | 0,600 | | |
| IC_3 | 0,640 | | |
| IC_4 | 0,670 | | |

The results show that the SDLI and EPSI items have been declared valid and reliable. This instrument is then integrated on the website with test items that are integrated into student independent learning activities. The case studies given are in accordance with the advice of the learning and material expert validators namely on the material "Annual floods of Aceh Tamiang Regency". The selection of themes is based on contextual problems that occur around students. Students are free to access the website and study independently with a student account that can be accessed with a student identification number.

### 3.4 Discussion

The result shown in the literature study, developing SDLI and EPSI resulted in mixed findings. This is because SDLI and EPSI were developed using several development phases to produce an exploratory analysis. SDLI and EPSI were developed according to student characteristics and validated based on 30 students with different academic levels and fields of study. The samples used for validity and reliability trials are unique because they take from different scientific fields and different academic levels. As research from [13], [14], states that the scientific field determines the achievement and entry of students in certain majors. The sample

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for the development of measuring instruments according to [15] is considered to take academic and scientific level variables. SDLI was also tested for validity and reliability for the validity of the measurement tool [16]. Therefore the SDLI and EPSI in this study seem to have a more suitable generalization and validity than measurements for the level of learning in tertiary institutions.

The SDLI developed in the research is expected to help students understand their independent learning. Measuring SDLI is suitable for adult learning such as the student level [17], [18]. By knowing their SDL, students can apply appropriate learning strategies [19]. Likewise, lecturers, through the results of student SDL assessments, can make decisions regarding appropriate learning strategies [20]. For example, the results of a literature study that has been conducted, reveal that the application of problem-based learning can increase self-directed learning [4], [21]. In the results of other literature studies, it reveals that inquiry learning can increase learning motivation which is part of the indicators of self-directed learning [22]. Futhermore, research from [18] describes that it is necessary to increase self-directed learning through the implementation of an independent learning curriculum.

On the other hand, EPSI which was developed from previous research [10] is a refinement of the instrument that has been developed. EPSI answers contextual problems and is developed based on case studies of environmental problems that occur in students. Through the presentation of dynamic problems in accordance with the context of real time events, it will increase the attractiveness of students to solve problems [23]. Another interesting literature review for developing SDLI and EPSI is the link between environmental problem-solving skills and independent learning. Research from [24] states that presenting solutions to environmental problems will increase self-directed learning. Presentation of contextual problems can give students a stimulus and motivation to solve problems [25]. Other literature studies also reveal that by knowing students' environmental problem-solving abilities, they can provide new ideas to lecturers regarding strategic innovations that can improve problem-solving abilities. For example research [6] describes through problem solving learning strategies assisted by the use of technology can improve problem solving abilities and independent learning.

This instrument is applied to an integrated website to support student independent learning. SDLI and EPSI which are integrated with the website can help students to self-reflect on independent learning and problem-solving skills. As research from [26], [27] revealed that websites can organize and record learning outcomes well. This recording is holistic and relevant to students so it is hoped that it can help students develop independent learning and environmental problem-solving skills. On the other hand, using the website makes it easier for students to carry assessment instruments easily [27].

Independent learning and environmental problem-solving skills require students who are skilled at finding information from various sources. The ability to find sources of information includes the ability to find sources of information from the internet. The development of website-based SDLI and EPSI supports the idea that making instruments in online assessments is an important component of efforts to increase student independence in learning and solving environmental problems. Previous studies stated that through website-based assessments,

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instruments can be quickly evaluated and return immediate results [27], [28]. The online assessment system plays an important role in helping students get scores and get automatic recommendations.

## 4. CONCLUSION

Development of SDLI and EPSI is carried out based on research. Development produces evaluation instruments for higher education students. The characteristics of the instrument suit the needs of students and are compatible with online learning. An evaluation tool developed using the WordPress platform designed as e-learning which is popularly used in higher education learning. Website-based SDLI and EPSI can be used freely by students and provide easy access so that students.

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**References**

1) N. Casinader and G. Kidman, "Fieldwork, sustainability, and environmental education: The centrality of geographical inquiry," *Aust. J. Environ. Educ.*, vol. 34, no. 1, pp. 1–17, 2018, doi: 10.1017/aee.2018.12.

2) V. Kioupi and N. Voulvoulis, "Education for Sustainable Development: A Systemic Framework for Connecting the SDGs to Educational Outcomes," *Sustain. 2019, Vol. 11, Page 6104*, vol. 11, no. 21, p. 6104, Nov. 2019, doi: 10.3390/SU11216104.

3) C. A. MacArthur, Z. A. Philippakos, and M. Ianetta, "Self-regulated strategy instruction in college developmental writing," *J. Educ. Psychol.*, vol. 107, no. 3, pp. 855–867, Aug. 2015, doi: 10.1037/EDU0000011.

4) M. H. Bidokht and A. Assareh, "Life-long learners through problem-based and self directed learning," *Procedia Comput. Sci.*, vol. 3, pp. 1446–1453, Jan. 2011, doi: 10.1016/J.PROCS.2011.01.028.

5) H. M. Linkous, "Self-directed learning and self-regulated learning: What's the difference? A literature analysis," *Am. Assoc. Adult Contin. Educ.*, pp. 118–122, 2021.

6) M. Bains, D. Z. Kaliski, and K. A. Goei, "Effect of self-regulated learning and technology-enhanced activities on anatomy learning, engagement, and course outcomes in a problem-based learning program," *https://doi.org/10.1152/advan.00039.2021*, vol. 46, no. 2, pp. 219–227, 2022, doi: 10.1152/ADVAN.00039.2021.

7) K. Al Shuaili, A. S. Al Musawi, and R. M. Hussain, "The effectiveness of using augmented reality in teaching geography curriculum on the achievement and attitudes of Omani 10th Grade Students," *Multidiscip. J. Educ. Soc. Technol. Sci.*, vol. 7, no. 2, p. 20, 2020, doi: 10.4995/muse.2020.13014.

8) A. Sholahuddin, E. Susilowati, B. K. Prahani, and E. Erman, "Using a cognitive style-based learning strategy to improve students' environmental knowledge and scientific literacy," *Int. J. Instr.*, vol. 14, no. 4, pp. 791–808, 2021, doi: 10.29333/iji.2021.14445a.

9) R. Awan, R. Sari, and S. Sumarmi, "Knowledge of Aceh ' s Maritime Potential Student Perception on Teaching Materials Development to Increase Students ' Knowledge of Aceh ' s Maritime Potential," no. January 2020, 2019, doi: 10.17478/jegys.618245.

The Seybold Report
ISSN 1533-9211
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10) Ridhwan, Sumarmi, I. N. Ruja, D. H. Utomo, and R. M. Sari, "Measuring students environmental problem solving ability across gender and school differences using paper based testing," *Int. J. Emerg. Technol. Learn.*, vol. 15, no. 13, pp. 303–320, 2020, doi: 10.3991/ijet.v15i13.11709.

11) W. Q. Shen, H. L. Chen, and Y. Hu, "The validity and reliability of the self-directed learning instrument (SDLI) in mainland Chinese nursing students," *BMC Med. Educ.*, vol. 14, no. 1, pp. 1–7, 2014, doi: 10.1186/1472-6920-14-108.

12) C. Justice, J. Rice, W. Warry, S. Inglis, S. Miller, and S. Sammon, "Inquiry in higher education: Reflections and directions on course design and teaching methods," *Innov. High. Educ.*, vol. 31, no. 4, pp. 201–214, 2007, doi: 10.1007/s10755-006-9021-9.

13) J. I. C. Hansen and J. L. Neuman, "Evidence of Concurrent Prediction of the Campbell Interest and Skill Survey (CISS) for College Major Selection," *http://dx.doi.org/10.1177/106907279900700304*, vol. 7, no. 3, pp. 239–247, Jul. 2016, doi: 10.1177/106907279900700304.

14) J. S. Kim, "The Effects of Major Selection Motivations on Dropout, Academic Achievement and Major Satisfactions of College Students Majoring in Foodservice and Culinary Arts," *Inf. 2020, Vol. 11, Page 444*, vol. 11, no. 9, p. 444, Sep. 2020, doi: 10.3390/INFO11090444.

15) K. L. Malone, W. J. Boone, A. Stammen, A. Schuchardt, L. Ding, and Z. Sabree, "Construction and Evaluation of an Instrumentto Measure High School Students Biological Content Knowledge," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 17, no. 12, 2021, doi: 10.29333/EJMSTE/11376.

16) Y. Y. and L. W. P. Richard P. Bagozzi, "Assesing Construct Validity in Organiational Research," *Adm. Sci. Q.*, vol. 36, no. 3, pp. 421–458, 2013.

17) N. Torabi and G. Aslani, "A study on self-directed learning among preliminary school teachers in Esfahan," *Procedia-Social Behav. Sci.*, vol. 83, pp. 219–223, 2013, doi: 10.1016/j.sbspro.2013.06.043.

18) C. H. Chen, K. Z. Chen, and H. F. Tsai, "Did Self-Directed Learning Curriculum Guidelines Change Taiwanese High-School Students' Self-Directed Learning Readiness?," *Asia-Pacific Educ. Res.*, vol. 31, no. 4, pp. 409–426, 2022, doi: 10.1007/s40299-021-00582-w.

19) F. Alradini, N. Ahmad, L. E. Kahloon, A. Javaid, and N. Al Zamil, "Measuring Readiness for Self-Directed Learning in Medical Undergraduates," *Adv. Med. Educ. Pract.*, vol. 13, pp. 449–455, May 2022, doi: 10.2147/AMEP.S360333.

20) M. D. Endedijk, M. Brekelmans, P. Sleegers, and J. D. Vermunt, "Measuring students' self-regulated learning in professional education: bridging the gap between event and aptitude measurements," *Qual. Quant.*, vol. 50, no. 5, pp. 2141–2164, Sep. 2016, doi: 10.1007/S11135-015-0255-4/FIGURES/4.

21) S. M. M. Loyens, J. Magda, R. M. J. P. Rikers, S. M. M. Loyens, R. M. J. P. Rikers, and J. Magda, "Self-Directed Learning in Problem-Based Learning and its Relationships with Self-Regulated Learning," *Educ. Psychol. Rev. 2008 204*, vol. 20, no. 4, pp. 411–427, Jul. 2008, doi: 10.1007/S10648-008-9082-7.

22) R. M. Sari, Sumarmi, I. K. Astina, D. H. Utomo, and Ridhwan, "Increasing Students Critical Thinking Skills and Learning Motivation Using Inquiry Mind Map," *Int. J. Emerg. Technol. Learn.*, vol. 16, no. 3, pp. 4–19, 2021, doi: 10.3991/ijet.v16i03.16515.

23) M. Baran, M. Baran, F. Karakoyun, and A. Maskan, "The Influence of Project-Based STEM (PjbL-STEM) Applications on the Development of 21st-Century Skills," *J. Turkish Sci. Educ.*, vol. 18, no. 4, pp. 798–815, 2021, doi: 10.36681/tused.2021.104.

24) E. Choi, R. Lindquist, and Y. Song, "Effects of problem-based learning vs. traditional lecture on Korean nursing students' critical thinking, problem-solving, and self-directed learning," *Nurse Educ. Today*, vol. 34, no. 1, pp. 52–56, Jan. 2014, doi: 10.1016/J.NEDT.2013.02.012.

The Seybold Report
ISSN 1533-9211
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25) Sumarmi, S. Bachri, A. Baidowi, and M. Aliman, "Problem-based service learning's effect on environmental concern and ability to write scientific papers," *Int. J. Instr.*, vol. 13, no. 4, pp. 161–176, 2020, doi: 10.29333/iji.2020.13411a.

26) I. Petunina, "Internet Technologies in Distance Education," *Int. J. Emerg. Technol. Learn.*, vol. 16, no. 10, pp. 85–95, 2021.

27) R. F. Kizilcec, M. Pérez-Sanagustín, and J. J. Maldonado, "Self-regulated learning strategies predict learner behavior and goal attainment in Massive Open Online Courses," *Comput. Educ.*, vol. 104, pp. 18–33, Jan. 2017, doi: 10.1016/J.COMPEDU.2016.10.001.

28) W. Chen, "The Blended Teaching and Learning Online and Offline From the Perspective of Independence and Interaction," vol. 493, no. Icesei, pp. 538–543, 2020, doi: 10.2991/assehr.k.201128.099.