

## Self-perceived action competence for sustainability of Indonesian prospective biology teachers

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**ABSTRACT:** This study was aimed to analyze the Self-Perceived Action Competence for Sustainability (SPACS) of Indonesian biology teacher candidates. This study was a cross-sectional survey. The data collection process is carried out in June-August 2022. The target respondents are students of education study programs in the field of biology from various institutions in Indonesia. Gender, GPA, college status, and college status are positioned as respondents' characters whose impact on students' SPACS is analyzed in this study. The target population size for this survey is 1300 people, the minimum sample size with 95% confidence level and 5% margin of error is 1235 students. The inclusion criteria of respondents in this study were prospective biology teacher students, came from universities in Indonesia, Indonesian citizens, still active as students, and voluntarily wanted to be involved as research respondent. To determine the effect of gender, university status, and student status on SPACS, the Mann Whitney test was carried out. On the other hand, to determine the effect of GPA on SPACS, the Kruskal-Wallis test was carried out. The results show significant differences occur in the variables that have a p-value (Sig. value) below 0.05. It can be concluded that significant differences in SPACS scores occur in gender differences to KAP, differences in university status to COI and WTA, and differences in study status to COI and WTA.

**Keywords:** SPACS, Prospective biology teacher, Indonesia, Action Competence

### 1 INTRODUCTION

Education for Sustainable Development (ESD) or Education for Sustainability (EfS) is a vehicle needed by community members to act in the form of contributing to a sustainable lifestyle and to overcome today's global challenges, including climate change, environmental degradation, consumerism, and so forth (Bascopé *et al.* 2019; Glavič 2020; Paulauskaite-Taraseviciene *et al.* 2022). One way to understand learning in the context of ESD is through the development of action competence (Chen and Liu 2020; Sass *et al.* 2020, 2022). Action competence is the competence to act with reference to the environment or the concept of

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sustainability (Hedefalk *et al.* 2014; Ideland 2016; Jensen and Schnack 2006; Kalla *et al.* 2022).

The actions of people who have action competence are committed and enthusiastic to solve sustainable development problems, have relevant knowledge about the problems being faced, are involved in taking a critical attitude, are positive about various ways to solve problems and have confidence in the – their own skills and capacities to change the conditions at hand for the better (Pauw *et al.* 2019). An action competence framework has been developed to help teachers and students achieve this competency development (Eames 2010; Lohmann *et al.* 2021).

To measure the action competence in students, it can be done with the self-perceived action competence for sustainability questionnaire (SPACS-Q). SPACS-Q is a relatively recently introduced instrument, supported by adequate theory and empirically reliable. SPACS-Q has been analyzed and meets the criteria of validity and reliability. SPACS-Q needs to be continuously introduced and used to investigate people's action competence in various sustainability contexts (Olsson *et al.* 2020).

Because this instrument or questionnaire is relatively new, it is necessary to use it to measure the action competence of students in Indonesia, especially students of prospective biology teacher. In the context of the prospective teacher, there is only one article that has been written, and even then, in the form of a systematic literature review. The article was published by Husamah *et al.* (2022) which proposes eight ideas to be reflected by prospective teachers or teacher education providers (especially science) in educating prospective science teachers who care about action competence. Meanwhile, there is only one publication that tries to reveal SPACS, namely new knowledge of the effects of Sustainability Education on young people's SPACS, through a longitudinal design.

In this regard, this study was intended to analyze the Self-Perceived Action Competence for Sustainability (SPACS) of Indonesian biology teacher candidates. This will be the first study in Indonesia (and possibly in the world) to implement SPACS-Q to measure student action competence. The results of this cross-sectional survey will be the baseline and policy basis for the development of action competence of Indonesian biology teacher candidates and in relation to the implementation of ESD or EfS.

## 2 METHODS

### 2.1 *Research design and participants*

This research is a type of cross-sectional survey. This study was conducted with the aim of collecting SPACS data for prospective biology teachers' students in Indonesia. Our data collection was carried out from June to August 2022. The respondents who were targeted in this study were students of education in the field of biology who studied at various universities in Indonesia (both at the Faculty of Teacher Training and Education, College of Education), as well as the Faculty of Mathematics and Natural Sciences). Gender, GPA, college status, and respondent's lecture status are positioned as respondents' characters whose impact on the SPACS aspect becomes the aspect that is analyzed.

The target population size in this survey is 1300 students. Therefore, based on the Krejcie and Morgan tables, the minimum sample size with 95% confidence level and 5% margin of error is 1235 students. The inclusion criteria of respondents determined in this study are prospective biology teachers, currently active in studying at various universities in Indonesia, they are Indonesian citizens, and respondents voluntarily or willingly become respondents in the study. They are students taking Biology Education degree. The exclusion criteria that we set in this study were students with diploma and postgraduate status, not from educational study programs, had been dropped out, and they were incomplete in providing information about their characteristics as respondents.

## 2.2 Instruments and procedures for data collection

The data collection instrument used in this study was the self-perceived competence for sustainability questionnaire (SPACS-Q) (Olsson *et al.* 2020) which was validated by bilingual experts. This questionnaire consists of 12 items using a 5-point Likert scale, ranging from not important (score 1) to extremely important (score 5). This survey was conducted online with the consideration that at the time of data collection Indonesia was still in the COVID-19 pandemic. Another consideration is that the target respondents are quite large and broad, so online techniques will be easier and more cost-effective. Therefore, we transformed our SPACS-Q into an online questionnaire via Google Form.

## 2.3 Data processing and analysis

We first download the data collected through the survey in a comma separated value (csv) format. Then the data was checked and labeled using Microsoft Excel. After the inspection and labeling were carried out, the data were then analyzed using SPSS. Data or information about the characteristics of the respondents were analyzed using frequency and percentage. We calculated the score against the mean and standard deviation for each item. The comparison of two groups of students was analyzed using the Mann-Whitney U Test, while the comparison of more than two groups was analyzed using the Kruskal-Wallis H Test. We determined that the alpha value was 5% in this study.

## 3 RESULTS AND DISCUSSION

Information on the demographic distribution of respondents in this study is presented in Table 1.

Table 1. Demographic distribution of respondent.

Group		Frequency	Percentage (%)
Gender	Male	177	13.97
	Female	1090	86.03
GPA	< 3	52	4.10
	3–3.5	552	43.57
	3.6–4.0	663	52.33
University Status	State University	765	60.38
	Public University	502	39.62
Student Status	Have taken the “Environmental Science” course	1011	79.79
	Haven’t taken the “Environmental Science” course	256	20.21

The average student answer scores for each SPACS item are presented in Table 2. Furthermore, to determine the effect of gender, PT status, and college status on SPACS, the independent samples t-test was carried out. On the other hand, to determine the effect of GPA on SPACS, a one-way ANOVA test was conducted. The summary of the results of the analysis of the four variables is presented in Table 3.

Significant differences occur in the variables that have a p-value (Sig. value) below 0.05. Based on Table 3, significant differences in SPACS scores occur in gender differences to KAP, differences in university status to COI and WTA, and differences in college status to COI and WTA.

Table 2. Average student answer scores in each SPACS item.

Item	Mean	SD
<i>Knowledge of action possibilities (KAP)</i>		
I can have a different point of view on an issue when people think differently.	3.71	0.96
I know how to take action on campus to contribute to sustainable development.	3.43	0.96
I know how to take action at home to contribute to sustainable development.	3.60	0.96
I know how to take action together with others to contribute to sustainable development.	3.52	0.95
<i>Confidence in one's own influence (COI)</i>		
I believe that my actions can have an impact on global sustainable development	3.57	0.98
I believe that my actions can have an impact on sustainable development in my community.	3.59	0.96
I believe that I have ample opportunity to participate in influencing our future together.	3.86	0.99
I believe that everyone's contribution is very important for sustainable development.	4.06	1.03
<i>Willingness to act (WTA)</i>		
I want to play a role in sustainable development in my community.	3.83	1.01
I want to play a role in global sustainable development.	3.84	1.02
I want to play a role in changing society towards sustainable development.	3.88	1.00
I want to do a lecture on how we can shape a sustainable future together.	3.98	1.03

Table 3. The difference in the mean SPACS scores in each group of students.

Group		KAP			COI			WTA		
		Average	SD	P-value	Average	SD	P-value	Average	SD	P-value
Gender	Male	3.72	0.82	0.006	3.83	0.91	0.278	3.88	0.96	0.970
	Female	3.54	0.82		3.76	0.87		3.88	0.92	
GPA	< 3	3.57	0.95	0.076	3.60	1.11	0.074	3.75	1.14	0.069
	3–3.5	3.50	0.82		3.73	0.87		3.83	0.92	
	3.6–4.0	3.61	0.81		3.82	0.85		3.94	0.91	
University Status	State University	3.59	0.81	0.081	3.85	0.85	<0.001	3.96	0.90	<0.001
	Public University	3.51	0.84		3.64	0.89		3.76	0.95	
Student Status	Have taken the "Environmental Science" course	3.58	0.81	0.119	3.80	0.86	0.009	3.93	0.90	0.002
	Haven't taken the "Environmental Science" course	3.49	0.88		3.64	0.92		3.71	1.00	

Gender has an effect on Knowledge of action possibilities (KAP), which is one aspect of action competence. This is in line with the findings of previous researchers that gender equality is a central aspect of sustainable development. The development of action competence is a key element in ESD efforts (Biström and Lundström 2021). Gaps in knowledge about gender can cause problems in sustainable development (Kim 2017; Leal Filho *et al.* 2022; Manandhar *et al.* 2018; Mérida-Serrano *et al.* 2020; Zimm *et al.* 2018). Furthermore, it is said that environmental education must be separated from the gender gap, where awareness of the sustainability of men and women must be the same. The issue of whether gender gaps in environmental education can be identified is also necessary in ESD continuing education is a teaching approach that can play a key role in reducing gender disparities. However, the

possible gender-specific effects of an ESD-oriented teaching approach have not been empirically tested (Olsson and Gericke 2017).

Differences in university status affect Confidence in one's own influence (COI) and Willingness to act (WTA), which are aspects of action competence. This finding indicates that university quality will affect the development of action competence. However, the university is uniquely placed to lead the cross-cutting implementation of the SDGs. This is the reason to build, strengthen and institutionalize university partnerships with government and society to achieve the SDGs. Therefore, it is necessary to change the mindset and culture in managing universities to face global challenges (El-Jardali *et al.* 2018). Universities can contribute a lot to achieve the sustainable development goals (SDGs). Involvement and attention to students is a broader form of work. Universities play a strategic role in generating innovations or new ways for the world, educating global citizens and bringing knowledge and innovation into society. Thus, universities can become engines of transformation for society, starting with the students they educate (Purcell *et al.* 2019).

In addition, the study status has an effect on aspects of Confidence in one's own influence (COI) and Willingness to act (WTA). Students' action competence must be taught and developed, particularly for prospective science teachers, to have a pedagogical perspective as environmental educators (Husamah *et al.* 2022). One way that can be done is by implementing environmental science courses. Environmental science is an amalgamation of scientific disciplines. The merging of scientific disciplines is important to overcome today's environmental challenges (Breiting *et al.* 1999; Theobald and Hancock 2019; Valle and Berdanier 2012). The concepts of "environmental science" and "sustainable development" are commonly used because of their proximity (Beames *et al.* 2018; Houé and Duchamp 2021; Larsson 2021; Murzi *et al.* 2019; O'Neill 2015; Pussella 2022; Rudskaia 2021; Solá and Vilhelmson 2019; Surya *et al.* 2020; Thompson 2005). In clarifying the nature, meaning, and relationships between these alternative concepts, this paper helps interdisciplinary researchers to understand the opportunities and challenges associated with each of these concepts (Sauvé *et al.* 2016).

#### 4 CONCLUSION

It can be concluded that significant differences in SPACS scores occur in gender differences with respect to Knowledge of action possibilities (KAP), differences in university status with respect to Confidence in one's own influence (COI) and Willingness to act (WTA), as well as differences in study status with respect to Confidence in one's own influence (COI) and Willingness to act (WTA). Thus, the factors that need to be considered in connection with the development of SPACS scores for prospective biology teacher students in Indonesia are gender, university status, and college status (Already taking the "Environmental Science" course).

Based on the aforementioned findings, some recommendations are addressed to further researches. First, teachers should pay attention to gender aspects in relation to the development of action competence and SPACS. Second, the status of universities (public or private) is still a key factor that describes the quality of each. Thus, the government needs to take policies to encourage even distribution of higher education quality. Third, environmental science courses as the embodiment of ESD and EfS in universities need to be taught appropriately, with appropriate strategies and methods, and managed by professional lecturers so as to encourage the achievement of the targets or objectives of these courses.

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