Action competence for sustainability instrument base on spirituality for prospective science teacher

Husamah[1], Hadi Suwono[2], Hadi Nur[3], Fardini Sabilah[4]
[1]Department of Biology Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, Malang, Indonesia
[2]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang, Malang, Indonesia
[3]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang, Malang, Indonesia
[4]Department of English Language Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, Malang, Indonesia

Article Info

ABSTRACT

Science teachers are the main actors in developing students' action competence for sustainability (ACS) in the future. Considering that the majority of teachers and prospective science teachers have a spiritual foundation, the spiritual aspect should be an integral part of the ACS. Therefore, an instrument is needed that can measure the level of ACS that includes aspects of spirituality in it. This study was designed to develop and validate an instrument for prospective science teacher in in the form of action competence for sustainability instrument base on spirituality (ACSIS). The instrument was developed based on previous research findings and focus group discussions involving eleven experts. The factors and internal consistency were examined by involving 634 prospective science teachers in Indonesia. Validity and reliability were tested using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). This study's results showed 21 questionnaire items (four dimensions) with acceptable internal validity and consistency. The ACSIS is recommended to measure the level of ACS for prospective science teachers, specifically in Indonesia, and countries that have the same characteristics of educational problems and potential.

Corresponding Author:

Husamah
Department of Biology Education, Faculty of Teacher Training and Education,
Universitas Muhammadiyah Malang
Jl. Raya Tlogomas 246, Malang 65144, East Java, Indonesia
Email: usya_bio@umm.ac.id

1. INTRODUCTION

Educational for sustainable development (ESD) which is now widely adopted is also oriented toward the development of action competence (AC). The AC is the knowledge and skills acquired so that a person can act critically. The concept of AC is the embodiment of critical thinking toward the environmental education that is carried out conventionally and it has been practiced for the last few decades [1]. The AC also reveals someone's critical action in accumulating various alternative solutions as a foundation for conducting an action to achieve sustainable future goals. The focus of AC must be conscious action in order to contribute to future environmental and sustainability realization [2].

The action competence is regarded as an urgent result of the environmental education process. Accordingly, environmental scientists and educators keep concentrating on the AC issue, which has recently been renamed the topic of action competence for sustainability (ACS) [3]. The ACS should be campaigned consistently even all over the world. This requirement must be met since AC and its relationship to issues of sustainable development are of global concern. Those issues are gradually matured and becomes a topic of

discussion, and even the concept of sustainability becomes the focus of the world [1]. Sustainable development is a popular issue in contemporary development discussions [4].

On the other hand, ACS as manifestation of achieving ESD needs to be taught and developed in students, particularly for those who are acted as prospective teacher. This step attempts to provide them the proper perspective as environmental educators [5]. In the context of ACS, teachers need to continuously develop their AC in order to be able to adapt and change dynamically to achieve sustainable development goals (SDGs). Educators who have AC will make the learning process carried out in line with the achievement of sustainable development. If this step is followed consistently and in a systematic manner, it will actively support collective-communal change, at least at the school where they work [6].

Previous researcher try to focus their research on the issue of ACS. Researcher have introduced professional AC in ESD and how to assess it, particularly for teachers [7]. Researcher also promotes the term of AC in sustainable development, which consisted of knowledge, willingness, capacity expectations, and outcome expectancy aspects [3]. In line with the circumstance, ACiSD-questionnaire has also been developed for students [8]. Monumentally, Olsson *et al*. [9] have developed the SPACS-questionnaire to measure or investigate people's ACS in various contexts, has not been associated with the spiritual aspect. Indeed, environmental sustainability is related to - and cannot be separated from - human spirituality [10]. Spirituality will motivate humans to keep the ecological balance by shifting their attention from a mechanistic and materialistic view to an organic-transcendental view of the environment. Beliefs, religious orientations, divinity, spiritual experiences, and altruistic behavior are all linked to sustainable behavior in humans [11]. However, it is believed that human holistic evolution can occur with a balance of material and non-material aspects of spiritual, cultural, social, and environmental. This demonstrates how close the relationship between SDGs and spirituality is [12].

Hence, this study aimed to develop action competence for sustainability instrument base on spirituality (ACSIS) to measure the prospective science teachers' ACS. This study is in line with the recommendation of the previous review that ACS needs to be integrated with spirituality and religiosity, it is very suitable for countries that are closely related to religious values like Indonesia [13]–[15]. The researchers connect this study with other domains of self-perceived which is linear to an AC, namely self-perceived spiritual competence or religious beliefs and practices [16]. Scientist believe that a person's spiritual awareness influences their ability to be accepted. Spirituality is positively correlated with acceptance of one's own perceived competence, particularly when taking action or direct/real action [17].

Experts report a relationship between acceptance of one's spirituality and involvement in helping others. Spirituality, for example, can influence a person's decision to integrate religious/spiritual issues into treatment and accept competence to assist clients [18]. A person's attitudes and beliefs about spirituality can be related to the frequency or acceptance of competence in conducting assessments and interventions (actions) [19]. According to a study, it is crucial to regularly evaluate students' perceptions, well-being, and acceptance of their competence in the context of spiritual education [20].

This study was designed to develop and validate an instrument for Indonesian prospective science teacher in in the form of ACSIS. This study is expected to give contribution to the development of studies of ACS, in which it can be a reference for the next researchers. The researchers try to gain a valid instrument so that it can be used to measure the ACS of prospective science teachers in countries that have a belief that spirituality is important for society, and for the countries that make religion and spirituality as the main thing.

2.   METHOD

This study employed a mixed methods paradigm (qualitative and quantitative method), with one method being used to create an instrument in the form of the ACSIS that could be used to assess prospective science teachers' self-perceived ACS based on their spirituality. This instrument was developed in three stages. The development of domains and items was the first phase [14], [21]. The second stage involved expert validation, exploratory factor analysis (EFA), a context validity test, and data reduction. Construct validity and internal consistency from the questionnaire generated using confirmatory factor analysis (CFA) constituted the third stage.

2.1. Development of domains and items

In this qualitative stage, the researchers conducted an item preparation by looking for literature with several keywords including "AC", "ACS", "self-perceived spirituality", and "spirituality scale" both in Scopus database and Google Scholar. A review of the literature was focused on the ACS aspect as the basis for developing the instrument that the researchers will do. Based on this search, the researchers found the 12-items of Likert-scale. The scale included three subconstructs, namely: i) knowledge of action possibilities; ii) confidence in one's own influence; and iii) the willingness to act. These instruments were claimed as valid

based on the evidence provided [9]. The researchers adopted the items by Sass *et al.* [7] in which it was related to professional AC in education for sustainable development that consisted of three domains, namely willingness, knowledge of pedagogical approaches, and self-efficacy. In addition, researchers completed it using items consisting of social responsibility, environmentally friendly practices, performance and pro-environmental behavior [22]. In terms of spirituality, the researchers discovered that previous researchers developed the spirituality and spiritual care [23]. Moreover, Butler [24] had developed personal spirituality.

2.2. Expert validation

Based on the input of some experts, the researchers adopted the three sources. The researchers also added several items based on the literature that had been reviewed. Finally, the researchers compiled an ACSIS consisting of 41 items in four domains: i) knowledge of action possibilities (10 items); ii) confidence in one's own influence (10 items); iii) the willingness to act (10 items); and iv) personal spirituality practice (11 items). The questionnaires were compiled using a Likert scale consisting of five items.

2.3. Exploratory factor analysis and testing content validity and data reduction

Under the guidance of EFA and expert validation, this stage was completed. This quantitative stage of our study involved collecting a comprehensive questionnaire to assess the ACSIS of prospective science teachers. This stage is related to participants, procedure, and testing content validity and data reduction.

2.3.1. Participants

There were 634 students/teacher candidates from all over Indonesia: 35.9% Java, 22.6% Sumatra, 19.3% Bali/Nusa Tenggara, 14.5% Kalimantan, 4.8% Sulawesi, and 2.9% Papua/Maluku. The accreditation status of the study programs of the participants is quite varied: 53.3% were accredited B, 37.4% were accredited A, and 9.4% were accredited C. According to gender, most of the participants were female students; there were 83.6% of female and the rest of 16.4% were male. Meanwhile, participants' level semesters were varied, 30.6% were in 7th or 8th semester, 26.3% were in 5th or 6th semester, 25.2% were in 4th or 5th semester, and 4.1% was in 9th semester or more. This study's strength came from the respondents' varied backgrounds, which highlights how distinctive the participants' academic circumstances. The acquisition of 634 teacher candidates had already exceeded the required number, which was 100-150.

2.3.2. Procedure

In this study, the researchers distributed Google Form; thus, it was simple to distribute and reach participants, it was friendly to the environment, and it was not forceful since only the willing would fill in (voluntarily). The researchers collaborated with the lecturer, who was a member of the official organization, the Indonesian Biology Education Consortium, to make the distribution of the questionnaire easier. They assisted in the distribution of the questionnaire link to lecturers, who then distributed it to the students. As a result, the distribution could be said to be official, to have met the requirements/permits, and to be legal.

The draft of ACSIS obtained in the first stage would be delivered to the panel experts for reviewing so that it could determine its validity. The panel of experts consisted of 11 environmental science experts and they are experts in the field of instrument development. The experts already had experiences in teaching "environment and sustainability" material, they had been certified as proof that they were professionals, and had an "educational" background in at least one of their undergraduate education levels. These 11 experts were asked to conduct an assessment qualitatively on the content validity for each item elucidated in the questionnaire. All experts completed the assessment on each statement that existed in the questionnaire so that the questionnaire was easy to understand by the respondents, unambiguous, and reflected the aspects of ACS and spirituality. The experts were asked to read and check carefully so that there were no repetitive statements on the available items (constructively correct). They were also asked to give comments or notes for each item and choose an option related to the item such as suitable, correct, or does not match/delete.

The researcher calculated the content validity ratio for each item that had been assessed by the experts. From the assessment, all of the items were relevant (all content validity ratio values were above 0.80). Hence, the final results of this stage consisted of 40 items. However, some advice from experts needs to be taken into account, and the researchers will use it as feedback. These included typos, phrases that were written incorrectly or more than twice, terminology that did not follow Indonesian rules, and certain terms that were still in other languages.

2.3.3. Testing content validity and data reduction

By looking at the ACSIS responses from the students, content validity and data reduction were performed. The researchers examined the acquired scores using descriptive statistics, including the mean, standard deviation (SD), and item-total correlation (Pearson's product-moment correlation coefficient). EFA reduced items by identifying interrelated and eliminating items that had an identical meaning. The item

reduction stage produces a comprehensive questionnaire where the domains and items can reflect the ACS level of prospective teachers. The researchers counted the number of common domains based on eigenvalue >1 (greater than one). A varimax-based rotation method with Kaiser normalization was also used. If the rotated factor load was less than <0.50 or cross-loading was indicated, the researchers took item reduction action. The researchers also decided that if the existing public domain only had one item, it should be removed. As a result, we worked to ensure that each public domain had at least two items.

2.4. Construct validity and internal consistency with confirmatory factor analysis

The goal of this stage was for researchers to precisely and properly identify the materials that were in the public domain after being reduced. CFA was the method employed. The covariance matrix fit model was evaluated using maximum likelihood estimation. As a result, in this study, the researchers adhered to earlier research that utilized data matching indexes, such as the Chi-square goodness test ($\chi2/df$), root mean-square error from approximation (RMSEA), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and Tucker–Lewis's index (TLI). Generally, these criteria were used in the determination of model fit, namely $\chi2/df \leq 3.00$ and RMSEA of ≤ 0.08 [25], [26]; and GFI, AGFI, CFI, and TLI which performed the status was accepted if the value was ≥ 0.9 with a "good fit" indication [27]. Cronbach's alpha (CA), composite reliability (CR), and average variance extracted (AVE) were also utilized to ensure that the items of ACSIS were internal consistency. Multivariate analysis scientists, i.e. provided suggestions on the accepted value [28], namely CA (≥ 0.6), CR was ≥ 0.7, and AVE was ≥ 0.5. Even though, as an alternative, several experts provided the value of CR that was ≥ 0.6. The researchers also tested concurrent validity by connecting the four domains to the overall score.

3. RESULTS AND DISCUSSION

Table 1 presents the findings of the descriptive statistical analysis. The descriptive statistics analysis results show that the SD does not exceed 2.5 SD from the mean, and the value of r (Pearson correlation) has a significant and positive correlation (p value <0.01). Table 1 shows that the mean value of the questionnaire items is between 3.26 and 4.44, with a SD between 0.96 to 1.27. Pearson's product-moment correlation coefficient ranges from 0.385 to 0.931, with a significance of 0.000<0.01. Thus, all items in the ACSIS can be continued with the EFA test. The item reduction stage uses the EFA test, the results are presented in Table 2. According to the table, it can be seen that the results of EFA test show the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy, in which it is in a "very good/excellent" category with a value of 0.915. It is in line with the criteria elucidated by Kaiser [29].

The score of Bartlett test is 0.000 which shows that the data met the requirements for EFA test. The results of EFA test have identified six dimensions with a cumulative % of 67.193% (within the recommended range). There are 10 items with a loading factor of less than 0.5 among the 41 (i.e. items 26, 16, 28, 9, 11, 12) and cross loading (i.e. items 38, 18, 1, 14). As a result, the remaining 31 items are usable. The next stage is CFA; the results are shown in Figure 1.

Table 1. Results of descriptive statistical analysis

Item	Mean	SD	r	Item	Mean	SD	r
1	4.20	1.03	0.525**	21	4.12	1.12	0.931**
2	3.98	0.96	0.385**	22	4.04	1.11	0.868**
3	4.14	1.01	0.827**	23	4.12	1.13	0.879**
4	3.98	1.04	0.697**	24	4.22	1.11	0.915**
5	4.08	1.16	0.727**	25	4.28	1.18	0.773**
6	3.26	1.01	0.750**	26	4.00	1.23	0.788**
7	3.74	1.27	0.463**	27	3.96	1.13	0.786**
8	4.14	1.14	0.674**	28	4.22	1.13	0.883**
9	4.26	1.03	0.737**	29	4.14	1.03	0.810**
10	4.20	1.03	0.790**	30	4.06	1.22	0.710**
11	3.98	1.18	0.719**	31	4.00	1.07	0.892**
12	3.96	1.05	0.683**	32	4.02	1.06	0.767**
13	4.04	1.12	0.742**	33	4.14	1.14	0.866**
14	4.34	1.08	0.864**	34	3.98	1.10	0.741**
15	4.14	1.24	0.795**	35	4.42	1.03	0.890**
16	3.90	1.15	0.842**	36	4.08	1.06	0.821**
17	3.90	1.11	0.635**	37	4.22	1,05	0.894**
18	4.06	1.20	0.924**	38	4.26	1.10	0.913**
19	4.06	1.02	0.802**	39	4.36	1.08	0.865**
20	4.16	1.17	0.762**	40	4.44	1.05	0.881**
				41	4.26	0.99	0.834**

Table 2. EFA test

Dimension	Item	Loading factor	Eigenvalues	% of variance	Cumulative %
1	40	0.772	13.012	41.976	41.976
	39	0.760			
	35	0.720			
	25	0.640			
	5	0.616			
	8	0.593			
	15	0.585			
	41	0.556			
	6	0.538			
2	32	0.811	1.999	6.449	48.424
	31	0.757			
	33	0.756			
	34	0.673			
	36	0.650			
	37	0.645			
3	22	0.786	1.752	5.650	54.074
	23	0.644			
	21	0.627			
	24	0.569			
	13	0.526			
4	4	0.746	1.683	5.430	59.505
	3	0.718			
	2	0.698			
	7	0.576			
5	20	0.848	1.246	4.019	63.524
	30	0.807			
	10	0.731			
6	27	0.753	1.138	3.670	67.193
	29	0.677			
	19	0.632			
	17	0.621			

KMO MSA=0.915; Bartlett's test=0.000
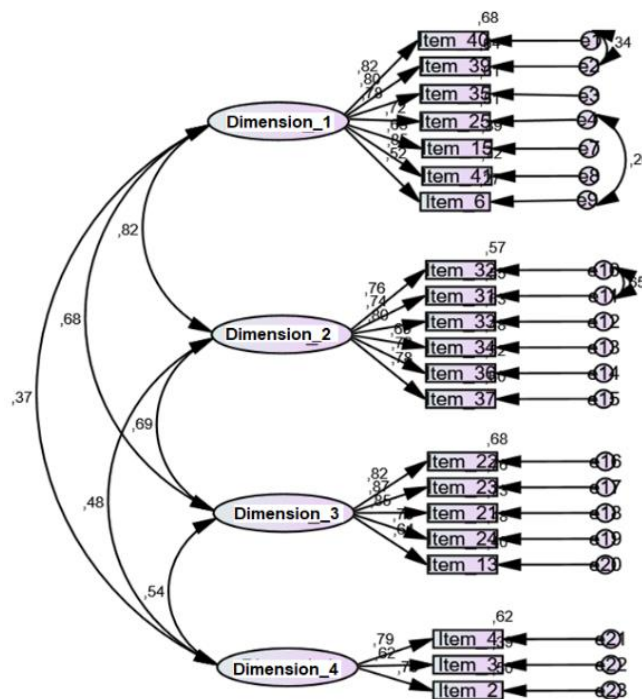
Figure 1. Results of CFA

The results of CFA with six dimensions (correlated model) exhibit the good of statistics which is not good and the value is χ2/df>3 and the values of GFI, AGFI, TLI, normed fit index (NFI), and CFI are far from 0.90, even below 0.70 (poor). Considering the deletion of several items with value lambda (λ) less than 0.5 (item 7) and items with modification indices (MI) that are too high with more than two other items in

different dimensions (e.g. items 5 and 8 in dimension 1 and all items in dimensions 5 and 6), then the GOF value can be increased by χ2/df=2.238 (good), GFI=0.869 and AGFI=0.832 (acceptable), NFI=0.883 (acceptable), TLI=0.920 and CFI=0.931 (good), and RMSEA=0.070 (good). Thus, there are up to 21 items remaining (4 dimensions).

Internal consistency analysis is the final stage. Data shows that the CR and CA values, both of which are ≥0.7, meet the criteria (values range 0.74-0.89; complete data is in the authors). In the meantime, the AVE value, ≥0.5, meets the criteria. As a result, all dimensions/items have internal consistency and can be employed. To obtain the final ACSIS, please contact the author.

This study is carried out to develop and validate the instruments of ACSIS that can be utilized to diagnose the level ACS for prospective science teachers, particularly in Indonesia and even other countries that have the same characteristics. The ACSIS is developed by means of rigorous statistical and psychometric processes as an effort to ensure that those instruments are valid and reliable. However, the aspect of self-perceived possessed by the teachers and prospective science teachers is very crucial to realize competencies related to SDGs. Teachers and teacher candidates have a significant role to achieve educational targets for sustainable development in particular and the SDGs. The role of the teacher is connected to the emergence of AC [30]. The researchers believe that the developed instrument will make an important contribution to measure and develop ACS for prospective science teachers and science teachers, particularly in Indonesia and other countries with similar characteristics. Many countries are beginning to recognize the importance of religion and spirituality to achieve educational targets for SDGs in general [31].

The analysis results show that this study is able to identify four domains, namely knowledge of action possibilities, confidence in one's own influence, the willingness to act and personal spirituality practice. This study is in accordance with the initial design, as the researchers have adopted into a single entity from various sources [7], [9], and even work with green practices [32]. This is also consistent with the spirituality domain that the researchers have chosen.

The variation in the number of items accepted by respondents reveals an intriguing phenomenon in the context of teacher candidates in Indonesia. Teacher candidates in Indonesia are very receptive to information about potential actions. This knowledge must be explicitly taught. The primary goal of environmental education is to empower students to act responsibly toward the environment. Acting responsibly necessitates the acquisition of environmental knowledge as well as positive attitudes and values toward the environment. Weak awareness of this is frequently due to the teacher's unfamiliarity with the theoretical and pedagogical aspects of environmental education. Participating in students' feedback and responses are one way to encourage knowledge to action [33]. Students at universities -including in this case prospective science teachers- should be autonomous learners. They must be able to adapt significantly to an educational environment that is full of changes and challenges. Entering higher education poses a self-regulating challenge for action [34]. The ability to act independently will undoubtedly support in the achievement of educational goals for sustainable development, namely the development of future citizens capable of making clear decisions and taking responsible actions to solve problems in their lives [1]. Thus, preparing students to be able to deal with sustainability's challenges both now and in the future is actually the learning outcome intended by ESD [3].

There are two items from the confidence in one's own influence that accepted by the prospective science teachers in Indonesia. This is the lowest. However, this can still be tolerated since science teacher candidates still have confidence in their own ability to influence sustainable development. Belief in one's own capacity and the actions that take by someone to make a positive change will contribute to sustainable development [3]. As a strategic skill for the 21st century, critical thinking has been identified by UNESCO as being related to one's confidence and self-confidence since it is connected to attitude change and personal and social improvement. Students have to significantly develop confidence in the components of AC under their own influence. In this regard, optimal support for teachers in developing self-confidence is crucial. This is one of the skills that must be constantly improved in order to face the future [35]. A study also reveals that students rely on their self-esteem and confidence to comprehend the dimensions of sustainability [36].

Prospective science teachers have willingness to act. It is critical to empower students to act in an environmentally responsible manner. Anyway, acting responsibly necessitates serious environmental knowledge development [37]. In the educational framework for sustainable development, it is critical for prospective teachers to express a willingness to act in order to address the various problems and challenges of sustainable development. Prospective science teachers, for instance, must be prepared to act in the context of climate change mitigation and adaptation [38]. Furthermore, this necessitates the reinforcement of personal values as part of the general principles that guide people's perceptions, goals, attitudes, and behavior. They are all referring to the desired outcome, which motivates an action to be taken [39], in this context is the aspect of sustainable development.

It is fascinating that the majority of the items chosen by the teacher candidates are about personal spirituality practice. This is a good thing in terms of efforts to integrate sustainable development or educational issues related to sustainable development with spiritual aspects. Religious literacy and spirituality, according to experts, are publicly relevant and important in preparing people involved in the world of education. Teachers will later shape and guide their students by instilling civic values and attitudes and developing the skills required for socio-economic development. Spirituality issues will be crucial in the future, especially in the activity of striving for personal integrity and wholeness in the context of the relationship between oneself and nature. The current environmental crisis, which is worsening, necessitates greater sensitivity on the part of all parties to the relationship between environmental problems and the various problems encountered. At this level, awareness of the importance of eco-spirituality is constantly increasing.

The CFA using a hierarchy model shows that personal spirituality practice dimensions have the highest path coefficient. This is also in line with several theories that have been stated before and other factors that needs to be added. Mainstreaming and enriching aspects of spirituality or religious values in relation to environmental problems is very necessary considering that nowadays there are "search" and "awareness" efforts to re-learn aspects of spirituality in modern society (including students) in responding to the complexity of the problems faced, including how religion/spirituality responds to environmental problems [40].

This study tries to develop and validate the ACSIS which is aimed at the prospective science teachers using analysis called as EFA and CFA. The sample size chosen is essential since it affects the analysis and the results obtained. The researchers use 634 of prospective science teachers. This amount has exceeded the minimum required amount, which is 100 to 150 [25]. The measurement results with the KMO test also shows excellent results. The number of final items that can be produced in this study is 21 (51.2%, of the initial 41 items).

This study's sample size is quite large, which may have implications for producing meaningful statistical power. CA coefficients are more significant than 0.80 for all items and most domains (total 0.94); these results indicate the reliability of the overall acceptable items in this questionnaire. There is one domain that has a CA coefficient value of 0.74, Nonetheless, because it is greater than 0.60, this number is considered more significant. This result still represents reliability [28]. It can be said that when referring to each domain and as a whole, the ACSIS can be used for further studies relating to an effort for measuring the aspect of ACS. The results of the internal consistency analysis show that the CR (0.75-0.89) and CA (0.74-0.89) have met the criteria, that is ≥0.7. Meanwhile, the value of AVE (0.50-0.61) has also met the criteria. Therefore, all dimensions/items have internal consistency so that it is feasible to be used. In brief, the four domains that generated together can be used to illustrate the aspect of ACS for prospective science teacher, specifically in Indonesian context.

The significance of this research is the production of an instrument regarding ACSIS. This research is an alternative for ESD researchers and lecturers in measuring students' ACS levels. The ACSIS is a valid instrument so it can be used to measure the ACS of prospective science teachers in countries that believe that spirituality is important for their society, and for countries that make religion and spirituality the main thing. Many countries still adhere to the fundamental-trendendental principle that ESD and real action (in this case ACS) are a form of "worship/servitude to God" so that this cannot be separated from spiritual values.

4. CONCLUSION

This study revealed a action competence for sustainability instrument base on spirituality with four domains (21 items): knowledge of action possibilities (four items), confidence in one's own influence (two items), willingness to act (five items), and personal spirituality practice (10 items). EFA and CFA are used to assess validity and reliability. Since all dimensions/items have internal consistency, they can be used to describe aspects of teacher candidates' ACS.

REFERENCES

[1] S.-Y. Chen and S.-Y. Liu, "Developing students' action competence for a sustainable future: a review of educational research," *Sustainability*, vol. 12, no. 4, p. 1374, Feb. 2020, doi: 10.3390/su12041374.

[2] E. Biström and R. Lundström, "Textbooks and action competence for sustainable development: an analysis of Swedish lower secondary level textbooks in geography and biology," *Environmental Education Research*, vol. 27, no. 2, pp. 279–294, 2021, doi: 10.1080/13504622.2020.1853063.

[3] W. Sass, S. de Maeyer, J. B.-de Pauw, and P. van Petegem, "Honing action competence in sustainable development: what happens in classrooms matters," *Environment, Development and Sustainability*, vol. 25, no. 4, pp. 3649–3670, Apr. 2023, doi: 10.1007/s10668-022-02195-9.

[4] J. Mensah, "Sustainable development: meaning, history, principles, pillars, and implications for human action: literature review," *Cogent Social Sciences*, vol. 5, no. 1, p. 1653531, Jan. 2019, doi: 10.1080/23311886.2019.1653531.

[5] A. C. Hadjichambis and D. Paraskeva-Hadjichambi, "Education for environmental citizenship: the pedagogical approach," in *Conceptualizing Environmental Citizenship for 21st Century Education*, Cham: Springer International Publishing, 2020, pp. 237–261, doi: 10.1007/978-3-030-20249-1_15.

[6] N. Silo and N. Mswela, "Creating healthy school environments through children – an action competence approach," *European Journal of Education Studies*, vol. 2, no. 6, pp. 46–62, 2016, doi: 10.46827/ejes.v0i0.265.

[7] W. Sass *et al.*, "Measuring professional action competence in education for sustainable development (PACesd)," *Environmental Education Research*, vol. 28, no. 2, pp. 260–275, Feb. 2022, doi: 10.1080/13504622.2021.1976731.

[8] W. Sass, J. B. de Pauw, S. de Maeyer, and P. van Petegem, "Development and validation of an instrument for measuring action competence in sustainable development within early adolescents: the action competence in sustainable development questionnaire (ACiSD-Q)," *Environmental Education Research*, vol. 27, no. 9, pp. 1284–1304, 2021, doi: 10.1080/13504622.2021.1888887.

[9] D. Olsson, N. Gericke, W. Sass, and J. B.-de Pauw, "Self-perceived action competence for sustainability: the theoretical grounding and empirical validation of a novel research instrument," *Environmental Education Research*, vol. 26, no. 5, pp. 742–760, May 2020, doi: 10.1080/13504622.2020.1736991.

[10] M. Hafeez, I. M. Yasin, D. Zawawi, N. A. Qureshi, S. T. Hussain, and M. Arif, "A review of the role of workplace spirituality and organizational citizenship behavior in enhancing corporate sustainability: an underpinning role of stern and Dietz's value model," *SAGE Open*, vol. 12, no. 2, p. 215824402210995, 2022, doi: 10.1177/21582440221099530.

[11] R. L. F. Bella, D. V. Barboza, O. L. G. Quelhas, M. J. Meiriño, and S. L. B. França, "Resilience meets sustainable and spiritual background into an initial review for the new normal after the COVID-19 pandemic," *Frontiers in Sustainability*, vol. 2, May 2021, doi: 10.3389/frsus.2021.638570.

[12] K. Gupta and R. Agrawal, "Sustainable development and spirituality: a critical analysis of GNH index," *International Journal of Social Economics*, vol. 44, no. 12, pp. 1919–1939, Dec. 2017, doi: 10.1108/IJSE-10-2015-0283.

[13] Husamah, H. Suwono, H. Nur, and A. Dharmawan, "Action competencies for sustainability and its implications to environmental education for prospective science teachers: a systematic literature review," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 18, no. 8, p. em2138, Jul. 2022, doi: 10.29333/ejmste/12235.

[14] Husamah, H. Suwono, H. Nur, and A. Dharmawan, "The development and validation of environmental literacy instrument based on spirituality for prospective science teachers," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 18, no. 12, p. em2206, 2022, doi: 10.29333/ejmste/12732.

[15] Husamah, H. Suwono, H. Nur, and A. Dharmawan, "Sustainable development research in Eurasia Journal of Mathematics, Science and Technology Education: a systematic literature review," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 18, no. 5, p. em2103, Apr. 2022, doi: 10.29333/ejmste/11965.

[16] C. M. Barry and L. J. Nelson, "The role of religious beliefs and practices on emerging adults' perceived competencies, perceived importance ratings, and global self-worth," *International Journal of Behavioral Development*, vol. 32, no. 6, pp. 509–521, 2008, doi: 10.1177/0165025408095555.

[17] L. Cobb, "The impact of spirituality on counseling students' self-perceived professional competencies," *Journal of Graduate Education Research*, vol. 2, no. 11, pp. 61–71, 2021.

[18] J. Freire, C. Moleiro, and D. H. Rosmarin, "Calling for awareness and knowledge: perspectives on religiosity, spirituality and mental health in a religious sample from Portugal (a mixed-methods study)," *Open Theology*, vol. 2, no. 1, pp. 681–699, Jul. 2016, doi: 10.1515/opth-2016-0053.

[19] M. L. Chen, Y. H. Chen, L. C. Lin, and L. L. Chuang, "Factors influencing the self-perceived competencies in spiritual care of nurses in the long-term care facilities," *Journal of Nursing Management*, vol. 28, no. 6, pp. 1286–1294, 2020, doi: 10.1111/jonm.13080.

[20] C. Brandstötter, F. S. Kundt, and P. Paal, "Spiritual well-being, attitude, involvement, perceptions and competencies: measuring the self-perception of nursing students during 2018, 2019 and the first wave of COVID-19 in 2020," *Health and Social Care Chaplaincy*, vol. 9, no. 2, pp. 175–190, Mar. 2021, doi: 10.1558/HSCC.18468.

[21] H. Suwono, L. Maulidia, M. Saefi, S. Kusairi, and C. Yuenyong, "The development and validation of an instrument of prospective science teachers' perceptions of scientific literacy," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 18, no. 1, p. em2068, 2022, doi: 10.29333/EJMSTE/11505.

[22] L. Suganthi, "Ecospirituality: a scale to measure an individual's reverential respect for the environment," *Ecopsychology*, vol. 11, no. 2, pp. 110–122, Jun. 2019, doi: 10.1089/eco.2018.0065.

[23] M. Fopka-Kowalczyk, M. Best, and M. Krajnik, "The spiritual supporter scale as a new tool for assessing spiritual care competencies in professionals: design, validation, and psychometric evaluation," *Journal of Religion and Health*, vol. 62, no. 3, pp. 2081–2111, Jun. 2023, doi: 10.1007/s10943-022-01608-3.

[24] J. Y. Butler, "Self-perceived spiritual competence of mental health professionals," Ph.D. dissertation, The Ohio State University, Columbus, USA, 2010.

[25] B. G. Tabachnick and L. S. Fidell, *Using multivariate statistics*, 7th ed. Pearson Education, 2018.

[26] R. E. Schumacker and R. G. Lomax, *A beginner's guide to structural equation modeling*, 4th ed. New York, NY: Routledge, 2016.

[27] C. Tedjokusumo and W. R. Murhadi, "Customer satisfaction as a mediator between service quality and customer loyalty: a case study of Bank Central Asia," *Jurnal Siasat Bisnis*, vol. 27, no. 2, pp. 156–170, 2023, doi: 10.20885/jsb.vol27.iss2.art3.

[28] S. Adeel, A. D. Daniel, and A. Botelho, "The effect of entrepreneurship education on the determinants of entrepreneurial behaviour among higher education students: a multi- group analysis," *Journal of Innovation & Knowledge*, vol. 8, no. 1, Jan. 2023, doi: 10.1016/j.jik.2023.100324.

[29] S. E. Raja, "Customer experience as an antecedent to market orientation: a mixed methods study of postgraduate students," M.S. thesis, University of Cape Town (UCT), Cape Town, South Africa, 2022.

[30] R. F. Schönstein and A. Budke, "Teaching action competence in education for sustainable development – a qualitative study on teachers' ideas, opinions, attitudes and self-conceptions," *Frontiers in Education*, vol. 8, 2024, doi: 10.3389/feduc.2023.1256849.

[31] W. L. Filho and A. C. McCrea, *Sustainability and the humanities*. Cham: Springer International Publishing, 2019.

[32] L. Suganthi, "Examining the relationship between corporate social responsibility, performance, employees' pro-environmental behavior at work with green practices as mediator," *Journal of Cleaner Production*, vol. 232, pp. 739–750, 2019, doi: 10.1016/j.jclepro.2019.05.295.

[33] M. Varela-Losada, P. Vega-Marcote, U. Pérez-Rodríguez, and M. Álvarez-Lires, "Going to action? A literature review on educational proposals in formal environmental education," *Environmental Education Research*, vol. 22, no. 3, pp. 390–421, 2016, doi: 10.1080/13504622.2015.1101751.

[34] N. M. Foerst, J. Klug, G. Jöstl, C. Spiel, and B. Schober, "Knowledge vs. action: discrepancies in university students' knowledge about and self-reported use of self-regulated learning strategies," *Frontiers in Psychology*, vol. 8, p. 1288, Jul. 2017, doi: 10.3389/fpsyg.2017.01288.

[35] J. C. Ortiz-Ordoñez, F. Stoller, and B. Remmele, "Promoting self-confidence, motivation and sustainable learning skills in basic education," *Procedia - Social and Behavioral Sciences*, vol. 171, pp. 982–986, Jan. 2015, doi: 10.1016/j.sbspro.2015.01.205.

[36] K. Alm, T. H. Beery, D. Eiblmeier, and T. Fahmy, "Students' learning sustainability – implicit, explicit or non-existent: a case study approach on students' key competencies addressing the SDGs in HEI program," *International Journal of Sustainability in Higher Education*, vol. 23, no. 8, pp. 60–84, 2022, doi: 10.1108/IJSHE-12-2020-0484.

[37] V. Kioupi and N. Voulvoulis, "The contribution of higher education to sustainability: the development and assessment of sustainability competences in a university case study," *Education Sciences*, vol. 12, no. 6, 2022, doi: 10.3390/educsci12060406.

[38] N. Vukelić, N. Rončević, and S. Toljan, "Student teachers' willingness to act in the climate change context," *Social Sciences*, vol. 11, no. 2, p. 47, Jan. 2022, doi: 10.3390/socsci11020047.

[39] A. Bask, M. Halme, M. Kallio, and M. Kuula, "Business students' value priorities and attitudes towards sustainable development," *Journal of Cleaner Production*, vol. 264, p. 121711, Aug. 2020, doi: 10.1016/j.jclepro.2020.121711.

[40] S. Altmeyer, "Religious education for ecological sustainability: an initial reality check using the example of everyday decision-making," *Journal of Religious Education*, vol. 69, no. 1, pp. 57–74, 2021, doi: 10.1007/s40839-020-00131-5.

BIOGRAPHIES OF AUTHORS

Husamah is an Assistant Professor at Department of Biology Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang. He completing his doctoral at the Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang in 2023. He has conducted a lot of research in the fields of education in biology, ecology, environmental science, and the integration between environmental science and education (including environmental literacy, educational for sustainable development, and spirituality). He has written many books on education and ecology/environmental science. He can be contacted at email: usya_bio@umm.ac.id.

Hadi Suwono is a Professor at Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang. His research focuses on STEM education, scientific literacy, biology education curriculum, transformative teaching and learning, and various topics related to active learning. Currently he is entrusted as the Dean of the Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang (2018-present). Currently he is also an Adjunct Professor at the Faculty of Science, Universiti Teknologi Malaysia. He can be contacted at email: hadi.suwono.fmipa@um.ac.id.

Hadi Nur is a Professor at Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang. Ph.D. in Chemistry, Universiti Teknologi Malaysia. He is also Head of Integrated Laboratory at Universitas Negeri Malang, and Adjunct Professor at Universiti Teknologi Malaysia. He has written hundreds of articles published in reputable international journals, has been a keynote speaker at various international conferences in various countries. His research focuses on advanced materials and heterogeneous catalysts and education (scientific literacy). He can be contacted at email: hadi@hadinur.net.

Fardini Sabilah is an Assistant Professor at English Language Education Department, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang (UMM), and permanent lecturer at Postgraduate Program of Master of English Education Program (S2) at the UMM. She received her doctoral degree from Linguistics Studies at Udayana University, Denpasar Bali in 2018. She has conducted a lot of research in the fields of English education, literacy, teaching English to young learners, and English teachers' professional development. She has written many books on education and English education. She can be contacted at email: fardini@umm.ac.id.