



European Journal of Educational Research

Volume 11, Issue 3, 1523 - 1534.

ISSN: 2165-8714

<https://www.eu-jer.com/>

Competency Framework of Agriculture Educators Vocational College: Measurement Model Using Partial Least Square-Structural Equation Modeling

Shuhada Abdul Raof* 
Universiti Teknologi Malaysia, MALAYSIA

Aede Hatib Musta'amal 
Universiti Teknologi Malaysia, MALAYSIA

Received: December 12, 2021 ▪ Revised: March 2, 2022 ▪ Accepted: May 18, 2022

Abstract: Competent instructors need to have the skills, abilities, and competencies to perform tasks effectively, which will affect student learning achievement. This study is guided by the theory of Boyatzis developed by Spencer and Spencer. The Iceberg Competency Model was used as a guideline to identify the competency elements of educators from the agricultural stream in vocational colleges (KV). This research study aims to explore and identify the existing competency elements of agricultural educators in KV. This study used a study population comprising 243 respondents of agricultural educators in KV. To answer the research question, the data analysis was done by Partial Least Squares - Structural Equation Modeling (PLS-SEM). This study is a study built to observe the relationship between the latent constructs studied. These constructs consisted of exogenous and endogenous constructs. In this study, exogenous constructs comprised value constructs, social roles, self-image, motives, traits and constraints. At the same time, endogenous constructs involved constructs of skills and knowledge. To ensure that the construct of this study gives meaning to the reflective measurement model, it was evaluated based on internal consistency reliability and validity. Regarding the framework, some indicators that did not qualify were dropped based on factor loading and average variance extracted (AVE). From the analysis conducted, 16 indicators were dropped since they did not meet PLS-SEM requirements. The total number of items retained was 71 indicators. At the final stage of this study, the evaluation model was implemented to form a framework involving the evaluation of the constructs linked to each other.

Keywords: Agriculture educators, competency framework, PLS-SEM, vocational college.

To cite this article: Abdul Raof, S., & Musta'amal, A. H. (2022). Competency framework of agriculture educators vocational college: Measurement model using partial least square-structural equation modeling. *European Journal of Educational Research*, 11(3), 1523-1534. <https://doi.org/10.12973/eu-jer.11.3.1523>

Introduction

Vocational colleges are the secondary level vocational education and training institutions that underwent restructuring in 2012. The general goal of establishing vocational colleges is to support the national education system, which aims to build high morale, knowledgeable and highly skilled human capital in technical and vocational education (TVET). Various challenges need to be faced by the Ministry of Education Malaysia, especially the Vocational Training and Technical Education Division, in transforming Malaysia's technical and vocational education system. These changes and restructuring also significantly impact the development of agricultural education programs in vocational colleges, especially involving the competence of teaching staff.

The agricultural sector has played an essential role in the social and economic development of the country. Along with the current development, the government's studies in agriculture are also emphasised by offering formal programs under the Ministry of Education Malaysia, Ministry of Higher Education and the Ministry of Agriculture and Food Industry. The field of agriculture covers a broad and diverse scope and skill areas. In addition, the development and progress achieved in this field are also quite encouraging. As a stakeholder in the industry, teaching staff in agricultural education is part of the agricultural workforce development process. Therefore, the teaching staff involved should have extensive knowledge of agriculture.

TVET instructors need to have skills in theoretical and practical areas; a combination of units that integrates knowledge, skills and attitudes in using materials, equipment, safety and methods to complete job-related tasks. Albritton and Roberts (2020) argue that agricultural educators need to have the specialised and technical knowledge to be considered

* Corresponding author:

Shuhada Abdul Raof, Universiti Teknologi Malaysia, Faculty of Social Sciences and Humanities, Malaysia. ✉ shuhada2@graduate.utm.my

experts in adapting to new technologies and agricultural practices in the field. Agricultural education that interferes with this success process is caused by the lack of qualified and competent teaching staff to fill the agricultural education program (Myers et al., 2005).

Instructors who conduct practical teaching in TVET educational institutions, especially in vocational colleges in agriculture, are expected to use their knowledge and skills in line with the skills training that has been followed. However, problems in practical teaching are still an obstacle to the delivery process. This is acknowledged by Albritton and Roberts (2020) as they stated that the lack of clear explanation by the instructors when practice sessions are conducted contributes to the problems in the practical implementation process. This opinion is supported by a preliminary study revealing that TVET institutions now have less exposure to skills when undergoing training in educational institutions. The problem of conducting practical training in the classroom occurs because the teaching staff lack knowledge and skills in practical implementation. A study in Colombia discovered that agricultural teachers lacked skills in operating agricultural machinery and equipment. Another study has also proven that some instructors admitted that they do not dare to use machines due to concerns about student safety (Tummons, 2017).

Sorensen et al. (2014) stated that agricultural education is among the disciplines that are often neglected in developing the professionalism of teachers, which in turn make them unmotivated in developing their potential. In this regard, the education program for teachers, lecturers or instructors is a priority in ensuring that competent agricultural instructors can be supplied to agricultural vocational colleges to implement an effective teaching and learning process. Therefore, an appropriate educational program plan needs to be drawn up to include technical skills training that needs to be followed by agricultural instructors. This situation ensures that the teaching staff in agriculture can master the knowledge, skills and positive behaviour.

Literature Review

Competence of Agriculture Educators

The professional skills and competencies of the teaching staff are essential factors in determining the success of the teaching process carried out (Grollmann, 2008; King Rice, 2003; Rivkin et al., 2005). The more advanced the agricultural technology, the higher the perceptions and expectations agricultural educators possess. All educational programs aim to supply adequate agricultural teaching staff. Nevertheless, stakeholders agreed that detailed course preparation and experience are essential in making an instructor effective in delivery (McLean & Camp, 2000; Roberts & Dyer, 2004). Educators play a role in shaping students with high quality, excellent and positive thinking. Effective teaching and learning processes will produce excellent and quality students. In addition, as an educator, it is necessary to have elements of competence such as mastering the content of the subjects taught and being knowledgeable in pedagogy. Instructors should also choose teaching resources, diversify teaching strategies, have high technological skills, good communication skills and have an upbeat personality. As an instructor in TVET, this element is essential to enable instructors to teach more wisely and competently. Dedicated instructors must constantly design, plan, implement and evaluate their teaching process so that the improvement of skills can be enhanced.

In this study, skills are referred to the skills of conducting practical activities by agricultural instructors in vocational colleges in implementing the teaching and learning process. For example, in this field of study itself, the skills that need to be possessed by agricultural instructors is to perform assisted pollination methods for crops. Skills in plant breeding and small operating machinery are other examples in agriculture. However, technological changes and shifting labour market demands have left such competencies vulnerable to decline. As an educator in this field, it is necessary to have skills in performing agricultural practices. Deegan et al. (2016) argued that the ability to handle animals is a critical component in agricultural education.

Knowledge is a complex competence. Syed Ali (2014) stressed that the mastery of subjects, which includes knowing teaching pedagogy is an element that must be mastered by an instructor. This situation ensures that teaching objectives can be achieved leading to the successful implementation of the teaching and learning process.

Farkas (2003), Jennings and DiPrete (2010) as well as Rosenbaum (2001) see social and behavioural skills as part of the education system that needs to be prioritised. A competent instructor needs to have these elements of competence so that the teaching and learning process could run smoothly. Five other elements underlying this competency in this behavioural competence are value, social role, self-image, trait and motive. Several behavioural competencies have been identified in previous studies of the field of agricultural education. Among the behavioural elements that have been reported in previous studies are interpersonal achievement motivation, positive image, job preferences, social interaction, openness, integrity, management in relationships, self-motivation, extrovert attitudes, and emotional stability (Breeding et al., 2018; Hainline & Wells, 2019; Morgan, 2010; Roberts & Dyer, 2004; Sorensen et al., 2014; Touchstone, 2015)

Constraints Faced

Research studies in agriculture education found that many instructors left the profession within the first five years of starting their careers (Smalley et al., 2019; Tippens et al., 2013). The knowledge of TVET instructors in technology is an

essential part of the education system. The use of ICT and the development of technology can make the learning and teaching process run smoothly, create a more exciting teaching environment and help teachers explore new knowledge more comprehensively. In addition, the use of technology in the teaching and learning process can increase knowledge and make learning exciting and not left behind. This opinion is supported in the study of Ismail et al. (2017), which stressed that TVET management and teachers should use ICT technology mechanisms to enhance knowledge integration and make ICT a thing that can revolutionise the teaching and learning process. As competent teachers, they need to be qualified and mandated to have SKM and Teaching Staff Certificate; Vocational Training Operation (VTO), Vocational Education and Training Implementation (VTE), and Vocational Education and Training Management (VTM) are recognised by the Skills Development Department. In addition, TVET instructors cannot be separated by constraints and problems in implementing TVET. The issue of incompetent teaching staff in educational institutions has been always emphasised and is not a new issue. The findings of Cardno (2006) stated that a handful of educators work in a challenging environment with increasing stress, which contributes to a negative attitude towards the task as an educator. Yopp et al. (2020) argued that agricultural teachers with insufficient skills for the teaching course will affect the delivery process and the efficiency of conducting classes. This opinion is supported in the study of Damit et al. (2021), discussing the issue of curriculum delivery including the implementation of OBE, which is still not mastered by TVET instructors.

Smalley et al. (2019) stated that a handful of teachers are not exposed to practical training while at university. This statement is also found in the study of Ismail et al. (2017), who stated that most teachers in the field of TVET are still less skilled in industry practices as they are graduates from various levels. The involvement of the industry in developing human capital and supporting the national TVET implementation policy, especially in assisting TVET instructors in sharing expertise and recognising the skills they have, is a high expectation in this field. A TVET instructor needs to have technical skills such as operating technical equipment like the latest manufacturing machines and computers equipped with the latest software in line with the IR 4.0. Rapidly evolving technology can only be found in the industry. In TVET education, the infrastructure facilities provided are limited. Logically, instructors need to gain experience in the industry before delivering lessons and become mentors and evaluators to TVET graduates. This opinion is supported in the study of Yopp et al. (2020) stating that as an expert in a field, they need to follow the appropriate training to acquire the following skills to complete a task well. In line with that, in ensuring that instructors in the field of TVET are exposed to high knowledge and skills, exposure to industrial attachment training programs needs to be implemented.

Based on the problems that have been discussed, it can be concluded that the teaching staff of agriculture in vocational colleges still have a lack of knowledge, skills and behavioural competencies in the implementation of theory and practice. Apart from that, the teaching staff in agriculture also experienced some constraints that prevented them from achieving the required competencies.

Purpose of Study

This study was guided by the theory that is the basis for forming the competency framework of agricultural educators in vocational colleges. In general, the theoretical framework of this study was formed based on Boyatzis (1982) theory, which was later developed by Spencer and Spencer (1993), who formed the Iceberg Competency Model. This iceberg competency model was chosen as it provides an overall explanation of the competency elements required by agricultural educators. In this research, the teaching force was the variable used as the basis for the formation of this study. All elements in the iceberg competency model were selected and used in explaining the formation of the framework. Theoretically, skills and knowledge in the context of this study are things that need to be mastered by teachers in the field of agricultural education. While the competency category is more difficult to develop and identify, it was composed of behavioural competencies. Among the behavioural competencies used in this study involved values, social roles, self-image, motives and traits. Overall, this theoretical framework is a foundation that uses the Iceberg Competency Model as a guide to determine the direction of the study of the competence of teaching staff in this field of agriculture.

This study has three research questions: (1) Is there a significant relationship between the constraints faced with the competence of skills and knowledge among agricultural instructors in vocational colleges? (2) Is there a significant relationship between skills and knowledge competencies with value competencies, social roles, self-image, motives and nature of agricultural teaching staff in vocational colleges? (3) What is the proposal for constructing a competency framework for agricultural teaching staff in vocational colleges?

Methodology

Research Design

This study is a mixed-method study using Sequential Exploratory Design, which has been applied by Creswell and Clark (2017). Borich's (1980) needs assessment was utilised to assess the ability and importance of each competency. This assessment model has been also used by Sorensen et al. (2014) to assess the ability and competence of agricultural teachers in developing needs according to career phases. After going through a pilot study, the instruments used were refined through face validity and content validity by experts.

The pilot study conducted in this study involved 30 agricultural instructors from agricultural vocational colleges. The pilot data of the study were analysed using the Rasch measurement model (Abdul Raof & Musta'amal, 2021). Ineligible items were dropped. The procedure of conducting this study was permitted by Vocational Training and Technical Education Division (BPLTV), Policy Planning and Research Division (EPRD), State Education Department (JPN) and the Director of KV involved. The online distribution of questionnaires involved the entire population of agricultural vocational instructors in Malaysian agricultural vocational colleges.

Sample and Data Collection

Respondents in this study consisted of all vocational instructors in agriculture who served in vocational colleges. This study used the entire population to answer the study questionnaire. It coincides with the opinion by Darusalam and Hussin (2021) that if a researcher takes the entire individual in the population, the study does not use a sample but the population that is the "target population". A *good study* is a study that uses a population as the study sample or by taking as many samples as possible that are close to the total population (Darusalam & Hussin, 2021). The population of this study was 287 respondents. The total population was obtained through the survey procedure through an official letter sent to Technical and Vocational Education Division. However, in the pilot study, the researcher took a total of 30 respondents in the administration of the pilot study. Therefore, this study used $N = 257$ people as study respondents.

Study Instrument

This study used two types of items in the research questionnaire. Multiple choices and five-point scale items were selected. The questionnaire consists of three parts, Part A: Demographics Respondents, Part B: Constraints faced and Part C: Elements of Competence. Questions that used multiple-choice items include gender, age, years as an educator, educational career path, courses taught and involvement in courses. The type of item used in this section is a single choice item where the respondent is asked to choose using (\surd) on the box provided. At the same time, the independent item asked respondents to state their answers without being given a choice or category. Whereas to analyze the data from the study respondents for constraints and competency elements items, five-point scale item was used. Respondents were asked to rate themselves according to a 5-point Likert scale obtained from the Anchors response type Likert scale recommended by Vagias (2006). The five-point scale used five scales where each scale was assigned with a corresponding score of 1 = Not at All True of Me, 2 = Slightly True of Me, 3 = Moderately True of Me, 4 = Very True of Me, 5 = Completely True of Me. The Likert type scale proposed in this study is an appropriate Likert type scale used to identify competence.

Employing PLS-SEM

This study used SEM to examine the interrelated relationships between various independent variables and simultaneous variables (Hair et al., 2017). The SEM technique uses quantitative data with the assumption of cause-and-effect relationships between variables and constructs in a model (Awang et al., 2018). SEM also provides a systematic technique for validating the relationship between constructs and indicators to test the relationship between constructs with a single model (Hair et al., 2017). In addition, SEM evaluates cause-and-effect relationships between multiple constructs simultaneously (Ahmad, 2017; Tabachnick & Fidell, 2001). The method of data analysis using SEM consisted of two analyses; the measurement framework that connects the construct with the items that measure the construct, and a structural framework that presents the cause-and-effect relationship between constructs in a study where this relationship is built based on theoretical support. These constructs are arranged in a structured model based on the hypotheses expressed in the theoretical framework. In research involving SEM, most researchers agreed on the merits of using a two-analysis approach rather than one analysis (Hair et al., 2017; Kline, 2005; Schumacker & Lomax, 2010; Zarm pou et al., 2012). Therefore, this study used PLS-SEM software for quantitative data analysis. The structure of the variables used in this study is shown in Figure 1.

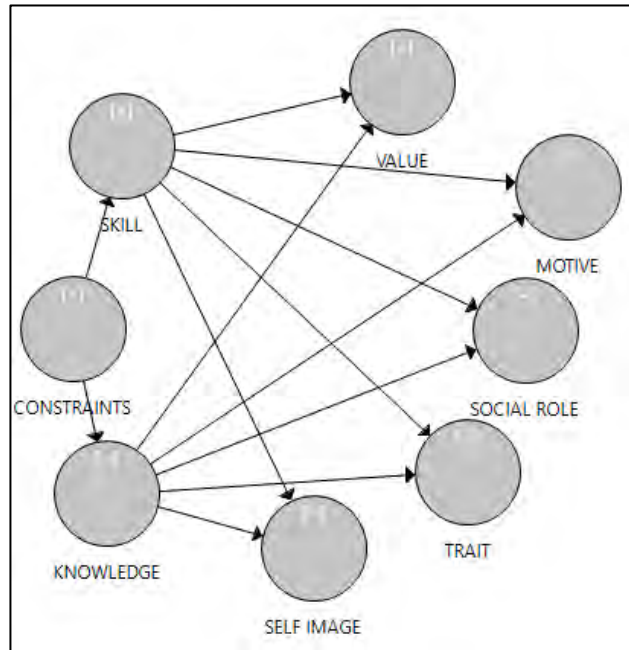


Figure 1. The Structure of the Variables

Analysis of Data

To answer the research question, some analyses need to be conducted. The first step in analysing the data is to review the questionnaire form. In this study, of 257 questionnaires received, there were 14 incomplete questionnaires with data outliers. A total of 243 completed questionnaires were processed and entered into SPSS 26 software and then PLS-SEM software for data testing involving missing values, straight-lining, outliers and data distribution normality. At this stage, a normality test needs to be performed on the data upon completion of the review process. This data isolation process uses skewness and kurtosis methods that show a normal data distribution. The conditions for SEM -PLS analysis for skewness and kurtosis values are ranged from -1 to 1, which is the range of data normality distribution required (Kamarudin et al., 2021).

Findings

Reflective Measurement Model Decision Assessment Analysis

This section discusses the evaluation of the results of the reflective measurement model. Measurement models need to be implemented to obtain reliability values for each indicator and construct studied. The indicator will be removed at this stage if there is a reading of the loading value that does not meet the requirements. After meeting the loading value requirements, the Cronbach's alpha reading of composite reliability (CR) must be seen to meet the internal consistency or internal consistency reliability. The next stage is the analysis to obtain the value of convergent validity based on factor loading and average variance extracted (AVE). At this stage, there will be a process of indicator removal to enable a further analysis to be carried out.

Table 1 shows the evaluation report of the reflective measurement model by construct.

Table 1. The Evaluation Report of the Reflective Measurement Model

Construct	Convergent Validity		Internal Consistency Reliability		Discriminant Validity
	Outer Loading	AVE (>0.50)	Composite Reliability (>0.708)		HTMT
Skill		0.615	0.927		
Knowledge		0.571	0.916		HTMT <0.9
Value	0.610-0.867	0.634	0.904		CI <1.0
Social Role		0.702	0.914		
Self-Image		0.644	0.890		
Motive		0.668	0.901		
Trait		0.582	0.917		
Constraints		0.516	0.863		

Based on the analysis conducted, 16 items were dropped as they did not meet PLS-SEM requirements. The total number of items retained was 71 indicators.

Structural Measurement Model Analysis

To obtain answers to research questions through these hypotheses, an analysis of structural models was conducted. Computational analysis was performed to determine whether or not the construct (Figure 1) directly influences other constructs. Table 2 shows the findings of the analysis of the structural measurement model.

Table 2. Findings From the Analysis of Structural Measurement Models

Hypotheses	Relationship	β	p	t	Result
H1	Constraints->Skills	-0.333	0.000	0.693	Accept
H2	Constraints ->Knowledge	-0.359	0.000	0.660	Accept
H3	Skills ->Value	0.306	0.001	3.273	Accept
H4	Knowledge ->Value	0.190	0.070	1.814	Reject
H5	Skills ->Social Role	0.263	0.008	2.646	Accept
H6	Knowledge ->Social Role	0.090	0.402	0.838	Reject
H7	Skills -> Self-Image	0.307	0.000	3.799	Accept
H8	Knowledge -> Self-Image	0.233	0.009	2.607	Accept
H9	Skills ->Motive	0.328	0.000	3.508	Accept
H10	Knowledge ->Motive	0.160	0.124	1.537	Reject
H11	Skills ->Trait	0.376	0.000	4.170	Accept
H12	Knowledge ->Trait	0.148	0.134	1.499	Reject

Based on Table 2, eight hypotheses were accepted and four hypotheses were rejected. The analysis showed that all hypotheses had the recommended path coefficient values of $\beta = 1$ and 1 and t values > 1.96. The decision to accept and reject this hypothesis was taken based on $p < 0.05$ (Hair et al., 2017).

Competency Framework Construction

Several analyses need to be conducted to form a competency framework. The conditions recommended in the PLS-SEM need to be complied with before the following analysis can proceed. After completing the evaluation of the measurement model involving the test of indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, the evaluation of the structural model can be continued. This evaluation model aims to form a framework involving the evaluation of constructs linked to each other. Subsequent analysis will involve tests based on coefficient criteria of determination (R^2), effect size assessment (f^2), predictive Relevance (Q^2), and effect size assessment (q^2). The structural model evaluation (internal model) test results can be assessed by the strength of the model and determined support for the hypotheses tested (Ali, 2019). Therefore, several steps need to be performed in the structural measurement model. An assessment of the collinearity issue (VIF) should be reported before proceeding to the next test steps. The VIF value in an analysis must have a VIF value > 5. VIF values more significant than five are considered to have collinearity problems. If this situation occurs, some actions need to be taken. However, in this study, all indicators met the conditions recommended by VIF > 5. Therefore, this study has no collinearity issues.

The subsequent analysis involved the total variance of dependent constructs explained by all independent constructs through R^2 assessment. Hair et al. (2017) categorised the value of R^2 into three values, namely large (0.75), medium (0.50), and small (0.25). Table 3 shows the expected accuracy values of the model.

Table 3. Expected Accuracy Values of the Model

Relationship	R2
Constraints->Skills	0.107
Constraints ->Knowledge	0.125
Skills ->Value	0.212
Knowledge ->Value	
Skills ->Social Role	0.106
Knowledge ->Social Role	
Skills -> Self-Image	0.252
Knowledge -> Self-Image	
Skills ->Motive	0.207
Knowledge ->Motive	
Skills ->Trait	0.243
Knowledge ->Trait	

Effect size is a method to identify the strength of the relationship between variables (Creswell, 2012). Furthermore, this evaluation involves f^2 analysis to identify constructs that are substantively affecting the value of R^2 (Kamarudin et al., 2021). Table 4 shows the f^2 results for the actual effect by the independent construct on the dependent construct.

Table 4. Results f^2 for the Actual Effect by IV to DV Construct

f^2 The actual effect shown by Independent Variable (IV) on Dependent Variable (DV)							
Construct	Self-Image	Skill	Motive	Value	Knowledge	Social Role	Trait
Constraints	---	0.125	---	---	0.148	---	---
Skill	0.053	---	0.057	0.050	---	0.032	0.078
Knowledge	0.030	---	0.014	0.019	---	0.004	---

The subsequent analysis involved a Q^2 assessment to identify how the endogenous constructs studied are relevant in shaping the model. This analysis was carried out using the blindfolding method by looking at the cross-validated redundancy construct. Table 5 shows the results of Q^2 values on the dependent construct.

Table 5. Results of Q^2 Values

Dependent Construct	Value Q^2
Skill	0.066
Knowledge	0.072
Value	0.128
Social Role	0.076
Self-Image	0.160
Motive	0.138
Trait	0.141

Table 5 shows the Q^2 values for skill constructs (0.066), knowledge (0.072), values (0.128), social roles (0.076), self-image (0.160), motives (0.138) and traits (0.141). All seven constructs were recorded to have Q^2 values above zero. This suggests that this model has sufficient predictive relevance for endogenous constructs. Figure 2 shows the results of the PLS test on the full model.

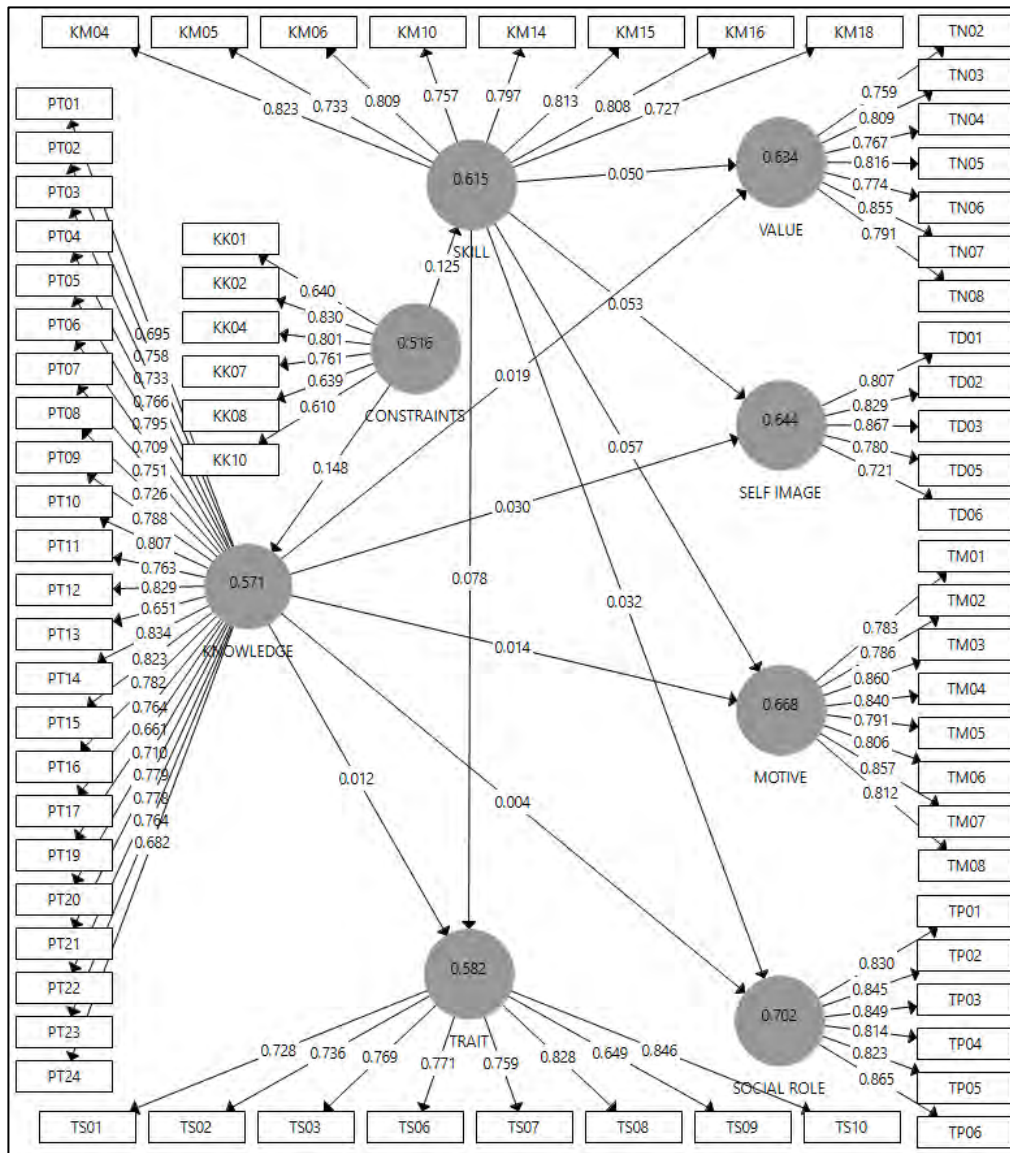


Figure 2. The Competency Framework of Vocational Stream Agriculture Instructors.

The figure above shows the competency framework of agricultural instructors in Malaysian agricultural vocational colleges, which consisted of 8 constructs and 71 indicators.

Discussion

The first result of this study showed that constraints have a significant adverse effect on knowledge and skills competencies. It means that several indicators are obstacles to the achievement of teaching staff competencies, which included the lack of training in the teaching of agriculture as a major constraint in achieving competencies. This result is in line with the finding by Harder et al. (2009), which stated that educators need training in improving competencies. Njura et al. (2020) also argued that skills in agriculture could not be achieved successfully if constraints such as problematic syllabi, excessive learning time, and insufficient teaching materials are present. Tummons (2017) stated that the lack of agricultural mechanisation skills contributes to the decline of incompetency. This study also found that agricultural educators thought that they have no motivation in agricultural education. These findings are aligned with a study by Smalley and Smith (2017) stating that the most significant barriers to instructors from becoming competent are lack of time and motivation. In addition, this study also coincides with DiBenedetto et al. (2018), which mentioned that professional development in teaching staff services is disrupted due to lack of efficiency in terms of computer technology and limited knowledge of teaching staff on current technology (Coley et al., 2015). Therefore, the above discussion results proved that constraints have a significant relationship with skills and knowledge competencies.

The following discussion is related to the relationship of skills and knowledge competencies with the elements of behavioural competence. The results showed that skills had a significant positive relationship with behavioural element competencies. These findings are aligned with studies (Wardlow & Johnson, 1999) stating that skill levels and interests have a significant positive relationship among agricultural teachers. These findings indicate that skills competence and

knowledge competence have a significant relationship with self-image competence; thus, the hypothesis of this study was accepted. In addition, Duncan et al. (2006) supported this study by stating that technical skills are an essential element. However, the level of competence in delivering teaching and learning is related to one's behaviour. These findings indicate that skill competence has a significant relationship with behavioural competence elements; thus, the hypothesis of this study was accepted. Darling-Hammond and Richardson (2009), Sorensen et al. (2014), as well as Wenglinsky and Silverstein (2006), added that courses related to improving knowledge and skills that are conducted positively impacted teachers' behaviour to increase effectiveness as educators. Moreover, the findings of this study are parallel to the study of Abdul Latip et al. (2020) who stated that motivation has a statistically significant relationship. However, from the relationship between knowledge competence and behavioural element competence, there was also a positive relationship, but the hypothesis was not accepted. This positive relationship was taken based on the path coefficient value (β) that has been discussed.

The knowledge competence of the teaching staff was found to be statistically insignificant and contradicts previous studies (Albritton & Roberts, 2020). This situation occurred statistically, but a positive relationship indicated that indicators of knowledge elements have a statistical relationship. However, this finding is also supported by Wang et al. (2019) who stated that although previous research has explored teachers' knowledge, there were some non-directional trust relationships. In addition, this study succeeded in producing a competency framework for agricultural instructors, which consisted of competency elements. This framework has a sufficient predictive relevance for endogenous constructs and met the recommended conditions.

Conclusion

This paper aims to produce a competency framework of agricultural teaching staff in Malaysian agricultural vocational colleges. This study has identified significant competency elements. In addition, this study has examined the constraints that affect the achievement of teaching staff competencies. Based on the data obtained, the indicators needed by competent agricultural instructors have been identified. The findings of this study are seen to contribute new results, especially in the field of agricultural education in agricultural vocational colleges in Malaysia. This study's findings can also be considered to be at the stage of new findings. In addition, from the aspect of competence, the indicators required by the teaching staff have been identified. The final findings of this study using PLS-SEM have found seven constructs with 65 indicators to indicate the competence of the teaching staff, along with one construct and six indicators showing constraints.

Therefore, continuous research is needed. The researcher hopes that the findings of this study can benefit researchers and educators interested in conducting new research or continuing existing studies related to agricultural education in agricultural vocational colleges for the scope of technical and vocational education in Malaysia. In addition, the analysis conducted has demonstrated that this competency framework is relevant and met the recommended requirements.

Recommendation

The results of this study have produced an element of competence required by agricultural teachers in carrying out the teaching process in agricultural vocational colleges. Indirectly, this competency framework describes the elements that need to be present and mastered by the teaching staff. Developing a competency framework in an organisation will be better with the right encouragement, direction, supervision, and intervention. In future studies, this competency framework can be used by adding more in-depth specifications for describing the competencies of agricultural instructors. This study can also be used as a platform for future research that aims to examine agricultural instructors' level of individual competence in the workplace. For future studies, it is proposed that the personal competencies of the instructors are assessed by looking at how the instructors carry out daily tasks by demonstrating skills or attributes in their tasks. Apart from that, the constraints faced also affect the achievement of the competencies of the teaching staff. The constraints faced by the teaching staff have been only discussed at the exploring and identifying stages. There should be studies related to the factors that hinder the achievement of competencies by considering relevant theories and models. It is necessary to conduct other studies by giving an in-depth focus on the constraints faced by the teaching staff. Subsequent studies may also explore other study samples using this competency framework as the basis for further studies. These are some of the recommendations for future research that could be made to ascertain plans for future development.

Limitations

This study only focused on the elements of competence required by the vocational teaching staff of agriculture streams in Malaysian agricultural vocational colleges. Furthermore, this study examined only one population involving a group of agricultural teaching staff. Apart from that, this study is also a mixed study exploring qualitative methods. Future research should focus on full interviews with experts in vocational colleges, universities and the division of vocational-technical education and training. It is hoped that many research studies can be carried out related to agricultural education in Malaysian agricultural vocational colleges.

Acknowledgments

We would like to acknowledge the support of Scholarship and Finance, Ministry of Education Malaysia under HLP 2019. We would also like to express my gratitude to the Universiti Teknologi Malaysia (UTM Fundamental Research-UTMFR 21H02) and all agricultural instructors from agricultural vocational colleges who are willing to participate in this study.

Authorship Contribution Statement

Abdul Raof: Conceived of the presented idea, developed the questionnaire and conducted research and analyzed the data, discussed the results and contributed to the final manuscript. Musta'amal: Conceived of the presented idea, reviewed and encouraged to investigate [a specific aspect] and supervised the findings of this work, discussed the results and contributed to the final manuscript

References

- Abdul Latip, M. S., Newaz, F. T., & Ramasamy, R. (2020). Students' perception of lecturers' competency and the effect on institution loyalty: The mediating role of students' satisfaction. *Asian Journal of University Education*, 16(2), 183-195. <https://doi.org/10.24191/ajue.v16i2.9155>
- Abdul Raof, S., & Musta'amal, A. H. (2021). Validity and reliability of instrument competencies framework of agriculture educators: The Rasch measurement model. *International Journal of Educational Methodology*, 7(3), 411-420. <https://doi.org/10.12973/ijem.7.3.411>
- Ahmad, M. F. (2017). *Mobile learning framework for automotive programme in Malaysian polytechnics* [Unpublished doctoral dissertation]. Universiti Teknologi Malaysia.
- Albritton, M. C., & Roberts, T. G. (2020). Agricultural technical skills needed by entry level agriculture teachers: A modified Delphi study. *Journal of Agriculture Education*, 61(1), 140-151. <https://doi.org/10.5032/jae.2020.01140>
- Ali, A. (2019). *Aplikasi asas SmartPLS dalam kajian sains social* [Basic application of SmartPLS in social science studies] (2nd ed.). Penerbit UMT.
- Awang, Z., Hui, L. S., & Zainudin, N. F. S. (2018). *Simple approach SEM* (1st ed.). MPWS Rich Resources.
- Borich, G. D. (1980). A needs assessment model for conducting follow-up studies. *Journal of Teacher Education*, 31(3), 39-42. <https://doi.org/10.1177/002248718003100310>
- Boyatzis, R. (1982). *The competent manager*. Wiley.
- Breeding, L., Rayfield, J., & Smith, K. L. (2018). Lessons learned: Describing the preservice preparation experiences of early-career award-winning agricultural educators. *Journal of Agricultural Education*, 59(1), 86-99. <https://doi.org/10.5032/jae.2018.01086>
- Cardno, C. (2006). Leading change from within: Action research to strengthen curriculum leadership in a primary school. *School Leadership & Management*, 26(5), 453-471. <https://doi.org/10.1080/13632430601007907>
- Coley, M. D., Warner, W. J., Stair, K. S., Flowers, J. L., & Croom, D. B. (2015). Technology usage of Tennessee agriculture teachers. *Journal of Agriculture Education*, 56(3), 35-51. <https://doi.org/10.5032/jae.2015.03035>
- Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Merrill.
- Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications, Inc.
- Damit, M. A. A., Omar, M. K., & Puad, M. H. M. (2021). Issues and challenges of outcome-based education (OBE) implementation among Malaysian vocational college teachers. *International Journal of Academic Research in Business and Social Sciences*, 11(3), 197-211. <http://doi.org/10.6007/IJARBS/v11-i3/8624>
- Darling-Hammond, L., & Richardson, N. (2009). Teacher learning: What matters? *Educational Leadership*, 66(5), 46-53. <https://bit.ly/3slnUnl>
- Darusalam, G., & Hussin, S. (2021). *Metodologi penyelidikan dalam pendidikan* [Research methodology in education] (3rd ed.). Penerbit Universiti Malaya.
- Deegan, D., Wims, P., & Pettit, T. (2016). Practical skills training in agricultural education-A comparison between traditional and blended approaches. *The Journal of Agricultural Education and Extension*, 22(2), 145-161. <https://doi.org/10.1080/1389224X.2015.1063520>
- DiBenedetto, C., Wills, V., & Barrick, R. K. (2018). Needs assessment for school-based education teachers: A review of literature. *Journal of Agriculture Education*, 59(4), 52-71. <https://doi.org/10.5032/jae.2018.04052>

- Duncan, D. W., Ricketts, J. C., Peake, J. B., & Uessler, J. (2006). Teachers preparation and in service needs of Georgia agriculture teachers. *Journal of Agriculture Education*, 47(2), 24-35. <https://doi.org/10.5032/jae.2006.02024>
- Farkas, G. (2003). Cognitive skills and noncognitive traits and behaviors in stratification processes. *Annual Review of Sociology*, 29(1), 541-562. <https://doi.org/10.1146/annurev.soc.29.010202.100023>
- Grollmann, P. (2008). Professional competence as a benchmark for a European space of vocational education and training. *Journal of European Industrial Training*, 32(2/3), 138-156. <https://doi.org/10.1108/03090590810861686>
- Hainline, S. M., & Wells, T. (2019). Identifying of agricultural mechanics knowledge and skills needed by Iowa school based agricultural education teachers. *Journal of Agricultural Education*, 60(1), 59-79. <https://doi.org/10.5032/jae.2019.01059>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modelling (PLS-SEM)* (2nd ed.). Sage Publication. <https://doi.org/10.15358/9783800653614>
- Harder, A., Roberts, T. G., Stedman, N. L. P., Thoron, A., & Myers, B. E. (2009). An analysis of the teaching competencies of agricultural and life sciences faculty. *NACTA Journal*, 53(4), 49-55. <https://www.jstor.org/stable/43765412>
- Ismail, K., Nopiah, Z. M., Rasul, M. S., & Leong, P. C. (2017). Malaysian teachers' competency in technical vocational education and training: A review. Abdullah et al. *Regionalization and Harmonization in TVET*, (pp. 59-64). Taylor and Francis Group. <https://doi.org/10.1201/9781315166568-12>
- Jennings, J. L., & DiPrete, T. A. (2010). Teacher effects on social and behavioral skills in early elementary school. *Sociology of Education*, 83(2), 135-159. <https://doi.org/10.1177%2F0038040710368011>
- Kamarudin, N. Y., Ashari, Z. H. M., Yaacob, R., & Kosnin, A. M. (2021). *Analisis data kaedah SEM SmartPLS aplikasi asas dan langkah demi langkah* [Data analysis of SEM SmartPLS basic and step -by -step application methods] (1st ed.). Penerbit Universiti Teknologi Malaysia.
- King Rice, J. (2003). *Teacher quality: Understanding the effectiveness of teacher attributes*. Economic Policy Institute.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). Guilford Press.
- McLean, R. C., & Camp, W. G. (2000). An examination of selected preservice agricultural teacher education programs in the United States. *Journal of Agricultural Education*, 41(2), 25-35. <https://doi.org/10.50321/jae.20000.02025>
- Morgan, A. C. (2010). Competencies needed by agricultural communications graduates: An industry perspective. *Journal of Applied Communications*, 94(1-2), 19-32. <https://doi.org/10.4148/1051-0834.1184>
- Myers, E. B., Dyer, E. J., & Washburn, G. S. (2005). Problems facing beginning agriculture teachers. *Journal of Agricultural Education*, 46(3), 47-55. <https://doi.org/10.5032/jae.2005.03047>
- Njura, H. J., Kaberia, I. K., & Taaliu, S. T. (2020). Effect of agricultural teaching approaches on skills development for food security: A case of secondary schools in Embu County, Kenya. *Journal of Agricultural Education and Extension*, 26(3), 239-252. <https://doi.org/10.1080/1389224X.2019.1680401>
- Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, 73(2), 417-458. <https://doi.org/10.1111/j.1468-0262.2005.00584.x>
- Roberts, T. G., & Dyer, J. E. (2004). Characteristics of effective agriculture teachers. *Journal of Agricultural Education*, 45, 82-95. <https://doi.org/10.5032/jae.2004.04082>
- Rosenbaum, J. (2001). *Beyond college for all: Career paths for the forgotten half*. Russell Sage Foundation
- Schumacker, R. E., & Lomax, R. G. (2010). *A beginner's guide to structural equation Modelling* (3rd ed.). Routledge.
- Smalley, S., Hainline, S. M., & Sands, K. (2019). Scholl-based agricultural education teachers perceived professional development needs associated with teaching, classroom management and technical agriculture. *Journal of Agricultural Education*, 60(2), 85-98. <https://doi.org/10.5032.jae.02085>
- Smalley, S. W., & Smith, A. R. (2017). Professional development needs of mid career agriculture teachers. *Journal of Agricultural Education*, 58(4), 282-290. <https://doi.org/10.5032/jae.2017.04282>
- Sorensen, T. J., Lambert, M. D., & McKim, A. J. (2014). Examining Oregon agriculture teachers' professional development needs by career phase. *Journal of Agricultural Education*, 55(5), 140-154. <https://doi.org/10.5032/jae.2014.05140>
- Spencer, L. M., & Spencer, S. M. (1993). *Competence at work: Models for superior performance*. Wiley.
- Syed Ali, S. J. (2014). *Teacher competence in the practical teaching of construction technology in vocational colleges* [Unpublished master's thesis]. Universiti Teknologi Malaysia.

- Tabachnick, B., & Fidell, L. (2001). *Using multivariate statistics*. MA Pearson.
- Tippens, A., Ricketts, J., Morgan, A. C., Navarro, M., & Flanders, F. (2013). Factors related to teachers' intention to leave the classroom early. *Journal of Agricultural Education*, 54(4), 58-72. <https://doi.org/10.5032/jae.2013.04058>
- Touchstone, A. J. L. (2015). Professional development needs of beginning agricultural education teachers in Idaho. *Journal of Agricultural Education*, 56(2), 170-187. <https://doi.org/10.5032/jae.2015.02170>
- Tummons, J. (2017). Concerns of female preservice teachers in teaching and supervising the agriculture mechanics laboratory. *Journal of Agriculture education*, 58(3), 19-36. <https://doi.org/10.5032/jae.2017.03019>
- Vagias, W. M. (2006). *Likert-type scale response anchors*. Clemson International Institute for Tourism & Research Development, Department of Parks, Recreation and Tourism Management. Clemson University.
- Wang, H., Bhattacharyab, D., & Nelsona, B. J. (2019). Secondary agriculture teachers' knowledge, beliefs and, teaching practices of climate change. *The Journal of Agriculture Education and Extension*, 26(1), 5-17. <https://doi.org/10.1080/1389224X.2019.1699126>
- Wardlow, G. W., & Johnson, D. M. (1999). Level of teaching skills and interest in teaching improvement as perceived by faculty in a land-grant of agriculture. *Journal of Agriculture Education*, 40(4), 47-56. <https://doi.org/10.5032/jae.1999.04047>
- Wenglinsky, H., & Silverstein, S. (2006). The science training. *Educational Leadership*, 64(4), 24-29. <https://doi.org/10.7748/ns.19.21.31.s44>
- Yopp, M. A., Edgar, D., & Croom, D. B. (2020). Technical in-service needs of agriculture teachers in Georgia by career pathway. *Journal of Agricultural Education*, 61(2), 1-19. <https://doi.org/10.5032/jae.2020.02001>
- Zarmpou, T., Saprikis, V., Markos, A., & Valachopoulou, M. (2012). Modeling users' acceptance of mobile services. *Electronic Commerce Research*, 12(2), 225-248. <https://doi.org/10.1007/s10660-012-9092-x>