The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2022

Volume 25, Pages 76-85

IConSoS 2022: International Conference on Social Science Studies

Development of a Value -Based Curriculum Model for the Environment in the Vocational College Standard Curriculum in the Field of Refrigeration and Air Conditioning: A Needs Analysis

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Abstract: This curriculum model is a value-based model of environmental sustainability built through the Vocational College Standard Curriculum of Refrigeration and Air Conditioning (VCSC_ RAC). Concerning that, this study proposes a Research, Design and Development (DDR) approach which is a multi-method development research approach. The study will go through three phases and use several different research tools in each phase. The involvement of study participants from expert groups and user groups consisting of field lecturers will be able to provide various inputs and consider aspects of the model's needs in addressing the problem of the impact of refrigerants on the environment through VCSC_RAC. The purpose of this study is to identify the needs analysis for the development of this curriculum model. The study was conducted by survey method that is using questionnaires. Questionnaires were distributed to Vocational College (VC) lecturers in the field of Refrigeration and Air Conditioning (RAC) throughout Malaysia. Researchers have found that there is a need to build a value -based curriculum model for the environment. The findings of this study indicate the need for the curriculum model to be built through VCSC_RAC based on values towards the environment. The emphasis on the value aspect of the environment is very relevant so that the quality of teaching and learning in VC can be improved to provide students with values, awareness and responsibility towards the environment**.**

Keywords: Curriculum model, Needs analysis, Design and development, Suitability, Usability.

Introduction

Environmental Education should be a component of a holistic lifestyle because it is the knowledge that needs to be passed on to humans (Raman & Abu Bakar, 2019). Environmental Education should place a greater emphasis on ongoing and regular practice because this problem is entrenched in human attitudes and is less impactful despite the latest actions, laws, and advances in addressing environmental issues. Investing in the future construction of a sustainable society is the finest investment if it begins in the early stages of schooling (Raman & Abu Bakar, 2019).

The primary goal of education is to generate students who are environmentally conscious and enthusiastic. We need to be able to develop an understanding of community members first, which requires a transformative educational approach. Issues of environmental awareness and sustainability, as well as changing attitudes and behaviours toward the environment, society and economy, require a transformative educational approach

(Kalsoom & Khanam, 2017). If teachers are not equipped to teach the younger generation about the importance of environmental sustainability, there are also impediments for the next generation to solve environmental concerns (Ashmann & Franzen, 2017). If teachers are willing to teach about environmental sustainability, then there will be a profound impact on the students themselves. To deliver environmental education, teachers should consider the use of existing materials and human resources. The views of teachers who emphasize environmental sustainability awareness illustrate the importance of environmental sustainability. Teachers' practice can familiarize students with the concept of sustainability and develop an awareness of environmental sustainability in them to influence students' awareness (Major et al., 2017). All levels of society will be given awareness and be able to contribute to understanding and facilitate continuity, not only at the individual level. In learning content, this should be a core concept of continuous practice and teaching (Wamsler et al., 2018). In shaping the changes needed to achieve sustainable development, teachers play a very important role in producing teachers who are responsible for a sustainable future (UNESCO, 2010). Therefore, teacher education programs need improvement so that teachers' awareness and attitudes toward the environment become one of the things that affect the ability of teachers in the implementation of Environmental Education (Yusof et al., 2013). In the learning process, students need to go through behaviour and oral language both explicitly and implicitly. Teachers' positive attitudes towards environmental care are closely related to positive behaviours towards environmental care. Students also build knowledge and behaviour not only through a planned formal learning process but also based on observations made.

Problem Statement

RAC field students in VC follow the VCSC_RAC curriculum. Students in this RAC field will learn about refrigerants. Before students use refrigerants in their learning, they should be made aware of the dangers that these refrigerants pose to the environment, such as global warming and ozone layer depletion. Something must be done to avoid the current environmental degradation, which is growing increasingly frightening. Extreme weather conditions have been impacted by global warming and ozone layer depletion. To sustain and restore ecosystems, collective efforts and individual awareness must be increased (Aarnio-Linnanvuori, 2019). This problem that arises is rooted in human attitudes and behaviours themselves but is less effective even if there are legal actions or technological innovations created to solve this problem. Changes in attitudes and behaviours can only be achieved through education if it is put into practice (Yalcin et al., 2016). Most environmental awareness programmes should focus on environmental care and economic development awareness to provide a more sustainable environment in terms of social issues (Mahat et al., 2014). We must also remember that education is more than just the content of knowledge that must be transmitted; it is also a way of life that must be maintained. Because environmental education is taught across the curriculum in Malaysia, teachers must be creative in integrating lesson content with environmental education (Rahman et al., 2018). According to Mukaddes and Agnello (2009), students are given the opportunity in sustainable education to integrate considerations of the environment in taking any decision more prudently. Dedicated teachers can maintain, animate and instil positive values in students (Maheshwari, 2005).

Ozone is a molecule that contains 3 oxygen atoms. Ozone acts as an earth protector that absorbs ultraviolet rays from the sun. Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) are major ozone depleters in the stratosphere. Ozone Depleting Potential (ODP) is a scale that measures the ability of ozone-depleting substances or Ozone Depleting Substances (ODS) such as CFCs and HCFCs that destroy ozone. CFCs have a higher ODP than HCFCs. The ozone layer that protects the earth is undergoing depletion because of human activities. The effects of ozone depletion are such as skin cancer, eye diseases, weakening of the immune system and so on. Global warming is an increase in the average temperature of the air on the earth's surface and sea since the middle of the 20th century and is expected to continue. Global Warming Potential or Global Warming Potential (GWP) is a relative measure of the heat of greenhouse gases trapped in the atmosphere. The effects of global warming such as extreme weather changes, heat waves, prolonged hot weather as well as droughts will cause changes in the pattern of rainfall distribution.

The teacher in teaching and learning is a person who is always present and near to the students. Teachers are supposed to use VCSC_RAC to teach kids values that will help them appreciate the environment. This is a way for students to learn about the environment while servicing and maintaining the RAC system in the early phases of their education before entering the industrial sector. As a result, this curriculum model construction study is critical for integrating environmental values in VCSC_RAC. This is done to ensure that pupils are aware of the importance of the environment from a young age in the classroom before entering the industrial sector.

Purpose of the Study

This study aims to identify the need to build a curriculum model in VCSC_RAC based on values toward the environment.

Research Questions

Phase One (Needs Analysis)

a. Why is it necessary to build a Curriculum Model based on values towards the environment?
b. What are the content requirements in the construction of a value-based Curriculum Model for the environment?

Needs Analysis

Studies on the appreciation of students' values nowadays are very few (Mohamad Khairi et al., 2015). Researchers emphasize that students need to be provided with knowledge of values and must be reinforced with awareness, confidence, appreciation, and practice. This can only be done when the school is considered as an institution that is aware of the value aspect that can provide sufficient opportunities for students to appreciate and practice these noble values. According to Witkin (1997) needs analysis is a method used to identify the gap between the current situation and the target situation. While McKillip (1997) stated that needs analysis is the value of judgment for certain groups that have problems that need to be solved. Needs analysis aims to investigate existing issues and needs to build this curriculum model. The designed curriculum model can serve as a practical guide, on how learning pedagogy can help teachers meet the needs of students to attract their interest in the subject through engaging teaching methods (Saleh & Siraj, 2016). Needs analysis in this study will be conducted through a survey method to identify the need for the construction of this curriculum model based on the views of lecturers of Vocational College-Refrigerant and Air Conditioning (VC_RAC) in Malaysia. Study participants were given a set of questionnaires in the form of a Likert scale to obtain feedback on the need for the construction of this curriculum model.

The purpose of the questionnaire sent to VC_RAC instructors was to evaluate if they should have a curriculum model that includes the value aspect of awareness activities in their classes. This curriculum model can be used as a guide by lecturers in the teaching process, and its application is most effective when lecturers use it in workshops. The study's questionnaire items were created using Constructivism Theory and Priority Theory as a guide, as well as the Bennert Model (1974) and the Taba Development Model (1962). Model content requirements and model construction requirements are the two fundamental constructs explained by this theory. As a result, a requirements analysis study is required to determine the need for the creation of this curriculum model.

Operational Definition

Refrigerant

In a RAC system, a refrigerant is used as a heat absorber in the evaporator and removes that heat in the condenser. Under low-pressure conditions, the refrigerant changes shape from a cold liquid to a cold gas in the evaporator during the evaporation process. The refrigerant will change shape from a hot gas to a hot liquid under high-pressure conditions during the condensation process that takes place in the condenser. Other names for refrigerants are freon, fron, genetron, isotron and neon. These names exist based on the countries that use them. The use of refrigerant varies according to the system that requires it as well as having different boiling points at different pressures. There are 4 types of refrigerants according to the chemical elements contained in the refrigerants, namely CFC, HCFC, HFC and HC. Researchers will try to apply environmental elements in the curriculum model so that students have an environmentally responsible nature while doing the work of servicing the RAC system.

Environmental Education

The process of environmental education involving human interaction with the environment is known as Environmental Education. For the sake of universal well-being, humans need to manage the environment with full responsibility. It is a learning process to understand human interaction with the environment and how the environment is managed wisely. The focus of this scholarly paper is to build awareness, foster positive attitudes as well as encourage students to take note of issues related to the environment. Therefore, the definition of Environmental Education in this study refers to the application of environmental elements in VCSC_RAC.

Application of Environmental Values Through the Curriculum

According to the Center for Curriculum Development (1998), the application of values across the curriculum refers to the process of inserting, integrating, and making connections about the environment into the content of all subjects. The environmental elements to be implemented in VCSC_RAC are consistent with the integration in all subjects. RAC students will use cooling materials in teaching and learning up to the world of employment in the industrial sector after graduation. Therefore, the value requirement on the environment in the VCSC_RAC curriculum model is necessary.

VCSC_RAC

At Vocational Colleges (VC), VCSC is a specialized education curriculum for students pursuing post-secondary vocational education and training at VC. VCSC is formulated according to the occupational competency standards set by the occupational standards organization and its level of learning meets the requirements of the Malaysian Qualifications Framework (MQA) levels 1 to 4. The structure of VCSC consists of three modules namely (1) academic modules, (2) vocational modules and (3) competency modules (KPM, 2011). In 2012, VCSC was first introduced in 15 selected pilot VCs. In the context of the general goals of the national education system, VCSC is designed to form a strong, knowledgeable and highly skilled human capital, namely: (1) to produce students with high-level job competencies and meet the needs of the industry; (2) fostering professional character; (3) to produce competent students who are competitive entrepreneurs in their chosen vocational field; (4) provide knowledge for further studies at higher levels; and (5) fostering a love of lifelong learning (MOE, 2011a). In this context, VCSC refers to the VCSC of the RAC field.

Methodology

This paper aims to look at how this curriculum model acts as a special guide for RAC lecturers to apply values to the environment through their teaching. The model that will be designed can serve as a practical guide that allows this model to help lecturers meet the needs of students and be able to attract their interest in applying values to the environment through interesting teaching methods. This needs analysis study used a set of questionnaires for data collection. The questionnaire was adapted and modified from the study of Ariffin (2018). The questionnaire used a five-point Likert scale of 1 = strongly disagree, 2 = disagree, 3 = disagree, 4 = agree, and 5 = strongly agree. This questionnaire consists of 3 sections. Part A is related to demographic factors and contains 5 questions related to a career as a VC_RAC lecturer. Part B deals with the content requirements of the model on aspects of environmental values. Part C deals with the curriculum model construction requirements in the recommended VCSC_RAC. The respondents of the study consisted of lecturers who teach RAC subjects in VC around Malaysia involving the Southern Zone, Central Zone, Eastern Zone, Northern Zone, Sarawak Zone and Sabah Zone. A total of 121 respondents were involved in the study which was self-managed by the researchers through Google Forms distributed through *Whatsapp* and Telegram applications. The data obtained were analysed through descriptive statistics using SPSS Version 23. Descriptive statistics were used in this study because the data generated can be considered as a summary of the entire data set (Saleh & Siraj, 2016). It is also able to provide information directly and easily. The descriptive statistics used were frequency, percentage, mean and standard deviation. The analyses were performed using descriptive statistics including percentage, frequency, and mean score. This analysis was used to show the composition of respondents and demographic characteristics of teachers such as gender, age, VC_RAC zone, academic qualification, and teaching experience.

Table 1 Interpretation of mean score of VC_RAC lecturer approval (Pallant, J, 2010)

Mean Score	Mean Score Interpretation
1.00 – 2.33	Low
2.34 – 3.66	Medium
3.67 – 5.00	High

Findings

Section a (Demographics)

The distribution of respondent data is described as shown in Table 2 covering gender, age, academic qualification, VC_ RAC Zone and teaching experience.

Table 2. Demographics

Aspect		Percentage
Gender	Male	65.3% (N=79)
	Female	34.7% (N=42)
Age	20 until 30 years old	11.6% (N=14)
	31 until 40 years old	38.8% (N=47)
	41 until 50 years old	26.4% (N=32)
	51 until 60 years old	23.1 (N= 8)
Academic Qualification	Certificate/Diploma	4.1% (N=5)
	Bachelor's Degree	88.4% (N=107)
	Master's Degree	7.4% (N=9)
	Philosophy Doctor	0.8% (N=1)
Zon VC_RAC	VC Southern Zone	24% (N=29)
	VC Central Zone	24% (N=29)
	VC Eastern Zone	26.4% (N=23)
	VC Northern Zone	23.1% (N=21)
	VC Sarawak Zone	5.8% (N=7)
	VC Sabah Zone	12.9% (N=12)
Teaching Experience	Less than 2 years	5.8% (N=7)
	2 until 5 years	30.6% (N=37)
	6 until 10 years	5% (N=6)
	11 until 15 years	10.7% (N=13)
	15 until 20 years	5.8% (N=7)
	More than 20 years	43% (N=52)

A total of 121 VC_RAC lecturers were distributed by gender into 79 male lecturers (65.3%) and 42 female lecturers (34.7%). In terms of age, the highest percentage was in the group of 31 to 40 years (38.8%) while the group of 20 to 30 years had the lowest percentage. Next, for academic qualifications, the majority have a bachelor's degree while other qualifications have a low percentage. The percentage of VC_RAC lecturers who answered the questionnaire from the Zone in the Peninsula is higher than in the Sabah/Sarawak Zone because there is only one VC_RAC in Sarawak and 3 VC_RAC in Sabah compared to the number of VCs in the Peninsula. However, in terms of teaching experience, the percentage of VC_RAC lecturers who have been teaching for more than 20 years is ahead and recorded the highest percentage compared to other teaching period categories.

Overall, the findings of this need analysis questionnaire can be considered strong and answer the needs analysis research question because the respondents are comprised of field lecturers who have academic/professional qualifications and extensive teaching experience in the field of RAC. Most of them have taught for more than 10 years and have other qualifications such as Sijil Kemahiran Malaysia (SKM) book author, curriculum drafter, Assessing Officer of the Skills Development Department, Internal Verification Officer, Professional Technologist (TS) Malaysian Board of Technologist (MBOT), Vocational Training Officer (VTO) instructor certificate, Vocational Training Executive (VTE), skills competition judges and so on. The researcher found that the findings of the needs analysis obtained from these respondents who consist of RAC lecturers with extensive experience are the results of very valuable and high value and strong findings due to the aspects of the respondents that have been described in detail above.

Section B (Model Content Requirements)

This section is intended to determine the extent to which VC_RAC lecturers need this curriculum model in their teaching, and this is measured based on the question items that have been distributed to the respondents through the questionnaires. The level of needs is measured based on the interpretation of mean values which are divided into three levels of achievement, namely low level of achievement (Mean 1.00 to 2.33), medium level of achievement (Mean 2.34 to 3.66) and high level of achievement (Mean 3.67 to 5.00) (Pallant, J., 2010). Table 3 shows the analysis of all items found in the content requirements of this model. Overall, all items in the model content requirements construct are at a high level of interpretation. The interpretation of the mean score to obtain teachers' agreement on the need to build this curriculum model is shown in Table 3

Table 3. Mean scores and standard deviations for all items found in the model content requirements construct

	Item	Mean	Standard Deviation	Interpretation
1.	Elements of environmental values need to be implemented in the VCSC-RAC.	4.62	.536	High
2.	The application of elements of environmental values in VCSC-RAC can educate students to be concerned about the environment.	4.65	.512	High
3.	The application of value elements of the environment in VCSC-RAC can shape positive behaviours towards the environment.	4.56	.546	High
4.	The application of value elements of the environment in VCSC-RAC can provide knowledge and form a positive attitude towards the environment.	4.50	.565	High
5.	The application of value elements of the environment in VCSC-RAC can create the nature of interdependence between humans and the environment.	4.45	.516	High
6.	The cause of environmental pollution is human attitudes.	4.63	.519	High
7.	The quality of the environment is very important in a country.	4.67	.490	High
8.	Eco-friendly means not harming the environment.	4.64	.500	High
9.	Schools/educational institutions play a role in increasing students' awareness of the environment.	4.56	.546	High
10.	Teachers play a role in producing students who are positive towards the environment.	4.54	.563	High
11.	Teachers are responsible for achieving the objectives of value-based learning toward the environment.	4.36	.632	High
12.	Teachers play a role in raising awareness about the impact of refrigerant gases on students.	4.57	.560	High
13.	Teachers have a role in increasing students' awareness of global warming and ozone depletion due to the release of refrigerant gases into the atmosphere in teaching.	4.55	.562	High
14.	Teachers play a role in raising the awareness of students who belong to individuals who handle refrigerants and can have an impact on global warming and ozone layer depletion.	4.61	.522	High
15.	Teachers play a role in raising students' awareness of the responsibility not to release refrigerants into the atmosphere while doing maintenance work on Refrigeration and Air Conditioning systems.	4.60	.510	High

Table 4. Mean of overall construct model content requirements

Frequency (N)	Mean	Standard Deviation
121	4.5675	.39074

Based on Table 4, the mean value for the entire model's content requirements construct is 4.5675 while the standard deviation is .39074. This indicates that the selected respondents strongly agree with the content requirements of the model. This is because the level of agreement of the requirements to the content of the model is in the range of the 'agree' and 'strongly agree' scales. This indicates that a value-based model content on the environment in VCSC_RAC needs to be built as guidance in teaching to produce environmentally responsible students while using refrigerants in servicing and maintaining RAC systems.

Section C (Requirements for Model Construction)

Table 5 shows the analysis of all the items found in the requirements for the construction of this model. Overall, all items in the construct of requirements for the model are at a high level of interpretation.

Table 5. Mean scores and standard deviations on all items found in the construction requirements for model construction

	Item	Mean	Standard Deviation	Interpretation
1.	A comprehensive guide is needed to increase awareness of values towards the environment.	4.64	.483	High
2.	I need guidelines to increase the environmental values in teaching.	4.59	.543	High
3.	Increasing environmental values needs to have a specific process.	4.53	.533	High
4.	I need guidance in the process of increasing environmental values.	4.49	.593	High
5.	Students need to be guided with the right methods to increase the value of the environment.	4.60	.491	High
6.	The process of increasing the value of the environment should be based on various activities in teaching.	4.56	.546	High
7.	An activity-based model for increasing environmental values needs to be built.	4.50	.550	High
8.	The construction of teaching models is necessary for the application of values to the environment.	4.50	.550	High
9.	The construction of teaching models can promote environmental awareness among students.	4.49	.518	High
10.	The construction of teaching models is suitable for students in the field of Refrigeration and Air Conditioning who frequently use refrigerants.	4.52	.564	High

Based on Table 6, the mean value for the entire construct of the need for the construction of this model is 4.5413. This indicates that the selected respondents strongly agree with the model construction requirements. This is because the level of agreement of the requirements for model construction is in the range of 'agree' and 'strongly agree'. This indicates that the construction of value-based models of the environment in VCSC_RAC needs to be built as guidance in teaching to produce environmentally responsible students while using refrigerants in servicing and maintaining RAC systems.

Table 6. Mean for overall construct requirements for model construction

Frequency (N)	Mean	Standard Deviation
121	4.5413	.42459

Discussion and Implications of the Study

The National Philosophy of Education intends to produce balanced and harmonious human beings physically, emotionally, spiritually, and intellectually based on faith and obedience to God (Center for Curriculum Development, 2005). Producing a moral and ethical society is one of the challenges for the country to become a developed country by 2020 (Mohamad Khairi et al., 2015). To realize the country's aspirations, the stability and purity of the country's education system is an important foundation. In shaping morals, one needs to master knowledge, skills, and good attitudes.Findings for the first research question regarding the lecturer's perception of the need to build a model showed that respondents believe that this model can increase students' awareness of the environment. This is seen through the findings regarding the tendency of respondents to use this model as a guide in appropriate teaching based on the topics taught. Respondents' perceptions of the overall construct have shown a positive perception of the need for the construction of this model. This shows that the respondents agreed on the need to build a model that leads to students' awareness of the environment. This has been emphasized in VCSC_RAC which suggests that lecturers can use available resources more effectively to enable students to obtain additional information and resources.

The results of the needs analysis found in phase one showed that the respondents had a positive perception of the construction of the model which serves as a guide. In other words, the researcher has obtained a license to continue the study in phases after getting answers at the needs analysis stage. Findings from this needs analysis also support Chong's (2012) view that changes in education in Malaysia require changes in teaching and learning in the 21st century. Therefore, teaching and learning methods based on environmental awareness in VCSC_RAC should be exposed to students. These findings enable this model to be implemented as a support and guide for the lecturers in teaching. Since the findings of this needs analysis are support and guide to teaching, then these findings can be used as a platform to design a model that can be used as a guide by lecturers to create student awareness of the environment. This is one of the alternative approaches to teaching for the future and the formation of a flexible and organic curriculum according to the mould of the Industrial Revolution 4.0.

Conclusion

Findings from the needs analysis show that there is a need to produce a teaching guide that is based on environmental awareness as a guide to lecturers. This is in line with UNESCO's requirement that educators should also play a role in creating students' awareness of the environment. Educational practitioners need to take advantage and make the best use of opportunities to build a learning environment based on environmental awareness. The findings of this needs analysis show that it is time for researchers to be allowed to build a curriculum model as a guide in teaching. The construction of a value-based curriculum model for the environment should be implemented for this purpose. It can be concluded that the findings of the needs analysis indicate that there is a need to build a curriculum model that can create awareness of the impact of refrigerant emissions on the atmosphere that can cause global warming and ozone layer depletion.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Acknowledgements or Notes

This article was presented as an oral presentation at the International Conference on Social Science Studies (www.iconsos.net) conference held in Istanbul/Turkey on August 25-28, 2022.

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To cite this article:

Nasir, N., Ariffin, A. & Hashim, A.T.M (2022). Development of a value-based curriculum model for the environment ın the vocational college standard curriculum ın the field of refrigeration and air conditioning: a needs analysis. *The Eurasia Proceedings of Educational & Social Sciences (EPESS), 25*, 76-85.