

Implementing Science Curriculum in Teacher Training College: Science Lecturers' Perspective

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Abstract: This study aims to identify the influence of the dimensions of context, input, process and product in the implementation practices of Science lecturers in imparting PISMP Science Curriculum at Teacher Training College (TTC) Malaysia. The samples of the study consist of 105 Science lecturers who are currently serving and offering Science specialization at 20 TTCs all over Malaysia. Based on Structural Equation Modelling (SEM), it was found that the context dimension shows an influence on the product dimensions. Two elements in the context dimension which are the aim of the curriculum and the curriculum objective showed a significant contribution towards this dimension. Input dimension represented by the lesson content element; the pedagogical skills; the evaluation and assessment; and the selection and the usage of teaching and learning resources also showed a significant contribution on the product dimension. Process dimension represented by the implementation of teaching and learning element based on the lesson content; the implementation of the pedagogical skills; the implementation of evaluation and assessment; and also the implementation of the selection and the usage of teaching and learning resources also influenced the product dimension. In conclusion, the result of the study showed that the integrated influence of context, input, and process dimensions towards product dimension in the implementation practices of Science lecturers in imparting PISMP Science Curriculum is preferably better than practicing and implementing it loosely and separately. The study also found that in each dimension there is a significant element which contributes to the maximum implementation of the PISMP Science Curriculum. It is suggested that further research should be carried out by intergrating the profile established with the Science lecturers teaching methods in order to improve and to enhance the effectiveness of the implementation of the PISMP Science Curriculum in TTC in future.

Keywords: PISMP Science Curriculum, CIPP, Science Lecturer, Teacher Training College

INTRODUCTION

The Bachelor of Teaching (PISMP) is a teacher education program introduced in 2007 by the Ministry of Education. It is a four-year-degree program that is fully operated by the Teacher Training College. The PISMP developed its own curriculum design, which is a plan for learning to learn experiences and learning to teach experiences to produce professional and integrated teachers [1]. The curriculum provides dynamic characteristics, which are relevant, futuristic, responsive, integrated and holistic, and it has a humanistic approach. The application of the theory provides coherence between effective teaching and critical experiences that are ultimately aimed at lifelong learning. This is consistent with the recommendations of several experts [2,3,4] that curriculum is an important element and is the heart of the education system that will shape the next generation. It is also said

to be the component that drives the process of education.

However, a good curriculum cannot be implemented successfully apart from the role played by the lecturers themselves. The effectiveness of an educational system depends on the implementation of the curriculum. In school, teachers play an important role in ensuring the successful implementation of the curriculum [5,6] they are the core in determining the standards, quality and effectiveness of the education system [6]. In addition, lecturers become the implementers of the Teacher Education Philosophy in TTC to ensure its success. Therefore, teachers and lecturers are the most important people in the implementation of the curriculum in formal education with regard to the standards, quality and effectiveness of the educational system they establish.

Each stage in the education system must be addressed, monitored, reviewed, evaluated and improved, especially aspects that have been identified as weak, inadequate or outdated. This includes the methods for the implementation of teacher education at the Institute of Teacher Education. When an education program is implemented, there should be an evaluation following its implementation. Any problems revealed in the evaluation of its performance are indicative of the non-compliance of the educational innovation that was introduced [7].

Ali *et al.*, [3] stated that a curriculum is not a fixed entity, but can vary according to the economic situation, social interactions, and the current political context, which determine the goals of the curriculum. This observation applies to every country during the course of its development of educational curricula, including Malaysia. Concurrently, the curriculum practiced in IPG must also stay abreast of social and political interactions. This is supported by Sulaiman [8], who asserted that curriculum should be continuously evaluated to remain up to date. Thus, the TTC can enable the PISMP science curriculum to be effective.

The involvement of teacher-educators as curriculum designers [9,10] and trainers [11] is important, because teacher-educators not only need to master and implement the new curriculum introduced, but also are expected to be prepared to help students master the curriculum's requirements. This is necessary to prepare them for their academic and future careers [12]. Without a sound implementation, no curriculum can be evaluated to determine the degree to which it is successful [9], including the implementation of the PISMP science curriculum by the TTC.

The purpose of this study is to evaluate the implementation of the PISMP science curriculum by TTC science lecturers. The objectives of this study are:

- To determine the influence of the dimensions of context on the product in the implementation of the PISMP science curriculum by science lecturers in TTC.
- To determine the influence of the dimensions of input in the process on the product in the implementation of the PISMP science curriculum by science lecturers in TTC.
- To determine the influence of the dimensions of process on the product in the implementation of the PISMP science curriculum by science lecturers in TTC.

Theoretical Model

In this study, the researcher uses a conceptual framework based on the Context, Input, Process and Product (CIPP) model developed by Stufflebeam [13].

This conceptual framework is focused on the level of science lecturers in implementing the science curriculum in the Teacher Training College in Malaysia.

The first stage addresses the dimensions of context, which assess the level of implementation of the science curriculum by science lecturers based on the goals and objectives of the curriculum.

The second stage includes the dimensions of input. It assesses the level of implementation of the science curriculum by science lecturers based on the aspects of confidence and strength of skills. This dimension focuses on the knowledge and mastery of the subject content, the use of strategies and methods of teaching and learning, and the skill of the lecturers in choosing teaching and learning sources. There are studies indicating that educators' control of the content of the lesson affects student achievement [14,15].

The third stage involves the dimension of process. This dimension assesses the level of implementation of science lecturers in using a variety of strategies and methods of teaching and learning. This dimension evaluates the process of teaching and learning based on the content of the lesson, the implementation strategies and methods of teaching and learning, the use of resources and reference materials, and evaluations completed by students [15]. Stated that educators play a challenging role in carrying out the teaching process.

In terms of the product, the study examines the level of implementation of science lecturers in evaluating the effectiveness of the teaching and learning process conducted using an output ratio. The goal is to determine whether to address the strengths and skills that should be mastered by science lecturers or to identify recommendations to improve the effectiveness of the implementation of the science curriculum.

METHODOLOGY

Subjects and procedure

This study applies the survey approach. Based on this approach, data were collected using a questionnaire that consists of 74 items using a 5-point Likert scale. The study population is all lecturers who teach science in 20 TTC in Malaysia. This population is also the sample in the current study. Bungin [16] and Mohd Najib [17] suggested that the sample can be the entire population if the population is small. In this study, the number of respondents who answered the questionnaire was 105, or 74% of the sample, and thus, the criteria for the analyses were met.

According to Hair *et al.*, [18] a structural equation model can be used when the sample size is

more than 100 people, as was the case in this study. They also suggested that assessing the model fit and the structural equations requires different criteria in the appropriate fit index and the cut-off-value to ascertain whether or not the model is acceptable, as shown in the following table. These criteria were used to determine the findings in this study.

Statistical analysis

The data were analyzed using SPSS 20 and AMOS 20 in order to determine an overall model for

the influence of the dimensions of context, input, process and product in the implementation of Malaysia’s PISMP science curriculum.

RESULTS

Measure of reliability and validity

The research instrument used confirmatory factor analysis (CFA) to examine reliability and validity.

Table-1: Summarizes the results for the internal reliability (Cronbach’s alpha) and convergent validity (factor loading, composite reliability, average variance extracted) of the constructs.

Main construct	Construct	Item	Statement	Loading Factor	Cronbach’s Alpha (above 0.7)	Composite Reliability (above 0.6)	Average Variance Extracted (above 0.5)
Context	B1	B13	in line with the Philosophy of Teacher Education	.843	.883	.716	.925
		B14	consistent with the mission of the Institute of Teacher Education	.861			
		B17	consistent with the mission and vision of Philosophy of Teacher Education	.854			
	B2	B21	translating knowledge related to PISMP’s science subject components	.827			
		B22	translating scientific skills in science subject components	.842			
Input	C1	C12	diversify science teaching methods to enable students to use thinking skills	.840	.811	.718	.960
		C13	diversify approaches for teaching the same topic in teaching science	.835			
		C11	apply various teaching activities to enhance students' understanding of science	.802			
	C2	C22	apply the content to be taught in science lessons	.859			
		C21	translate the content to be taught in science lessons	.858			
	C3	C36	student assignments to evaluate students' understanding	.868			
		C34	administer tests and examinations to assess students' understanding of science	.846			
		C33	provide scientific tasks to students	.846			
	C4	C44	look for alternatives if there are not enough scientific reference sources	.846			
		C45	use a variety of sources in teaching and learning science effectively.	.854			

Process	D2	D23	diversify science teaching methods to enable students to use thinking skills	.839	.816	.708	.936
		D22	diversify approaches to teaching the same topic in science teaching	.821			
	D3	D37	student assignments to identify the weaknesses and strengths of science students	.828			
		D36	student assignments to evaluate students' understanding	.846			
	D4	D43	use other electronic media as science teaching and learning resources	.856			
		D44	look for alternatives if there are not enough scientific reference sources	.856			
Product	Pk11	analyze student achievement to evaluate their understanding by using various valuation approaches accordingly	.854	.879	0.711	.936	
	Pk7	evaluate effectiveness in increasing the scientific skills of students.	.845				
	Pk6	evaluate effectiveness in improving science students	.855				
	Pk15	modify teaching approaches based on feedback from student assessments	.806				
	Pk5	assess students' ability to apply their knowledge of science	.838				
	Pk8	assess students' ability to apply the approach to teaching and learning science	.859				

Table-2: Summary of Overall Model Discriminant Validity Index

Construct	KS	IT	PS	PK
KS	.962			
IT	.66	.980		
PS	.57	.62	.967	
PK	.51	.59	.62	.967

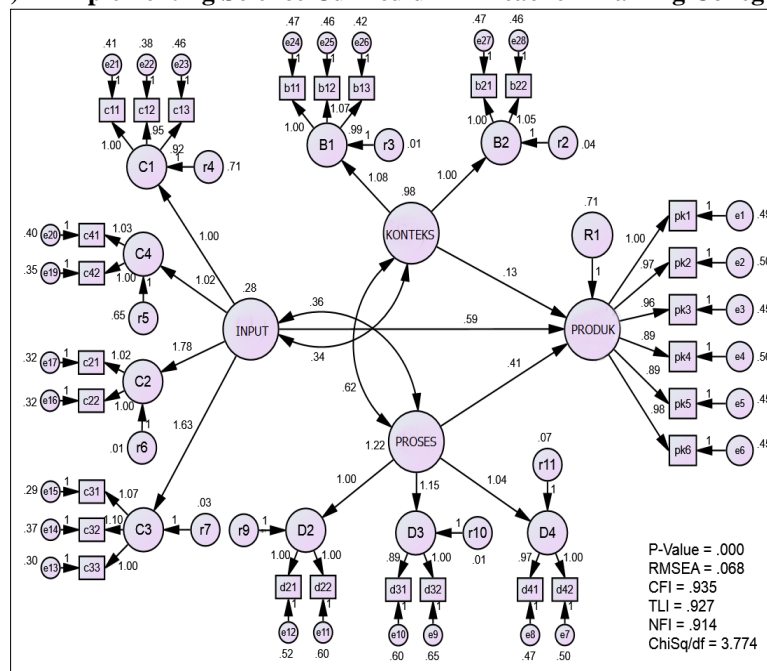
Table-3: Criteria Match Goodness (Goodness-of-Fit)

Bil.	Goodness Index	Match Criteria
1	Chi-square (x2)	Chi-square (x2) Reliability by cutting the (cut-off value) P <0.05 or P> 0.10 (the smaller the better)
2	RMSEA	0.05 - 0.08
3	GFI	> 0.90
4	AGFI	≥ 0.90
5	CMIN/DF	< 2.0
6	TLI	≥ 0.90
7	CFI	≥ 0.90

Source: Hair *et al.*, [18] Zainudin [19].

Structural model results

Table-4: Structural Model for Context (Konteks), Input (Input), Process (Proses) towards Product (Produk) in Implementing Science Curriculum in Teacher Training College



DISCUSSION

Influence of Context on the Product Dimension Relationships of PISMP Science Curriculum by Science Lecturers at TTC

The results indicate that two elements of the context, i.e. curriculum goals and objectives of the curriculum, contribute significantly to the dimensions of context in the implementation of the science curriculum at the Teacher Training College in Malaysia. This signifies that both elements are important for improving and restructuring the dimension of context in the implementation of the science curriculum.

However, the dimension of curriculum goals received a significant contribution from only three components, namely consistency with the Philosophy of Teacher Education, alignment with the mission of the Institute of Teacher Education, and alignment with the mission and vision of Philosophy of Teacher Education. This denotes that all three of these components have the same level of importance in improving the curriculum goals. The component, alignment with the Philosophy of Teacher Education, provides the greatest contribution, and the component, alignment with the mission and vision of Philosophy of Teacher Education, makes the smallest contribution. This implies that planning and programs for alignment with the mission and vision of the Philosophy of Teacher Education should be improved in order to obtain the context needed for the implementation of the science curriculum. This is consistent with Fritz's [20]

conclusion that the provision of relevant information, over time, can systematically support program planning and development activities, including the improvement of science curriculum. In addition, it is also consistent with Zawawi [21], who stated that the impact is detected based on accurate information. Thus, it requires a sustained effort; weaknesses at varying levels also must be remediated in order to improve and to ensure that the solutions can be executed immediately.

Meanwhile, the elements of the curriculum objectives receive a significant contribution from only two components, namely translating relevant knowledge of the components of science subjects and translating scientific skill. Both of these components are important to establish or formulate good objectives for science curriculum. The component that contributes the least to the objectives of the curriculum is translating scientific skills in science subjects. This shows that the component, scientific skill in science subjects for science lecturers, should be improved in the program and that activities related to this improvement must be undertaken regularly. This is consistent with the studies of Sharifah and Lewin [11] and Alias [22], who stated that the objectives of the curriculum should be formulated, based on the context of the implementation of the program, and that they can be carried out in a way that is more orderly and beneficial to students. According to Astuti and colleagues [23], the most important factor is the idea of learning as contextual learning, which has the potential to produce good

learning. There are only two components that affect the context of the objectives of the curriculum. Thus, if the context of the objectives of the science curriculum needs to be improved, enhanced or modified, these two components must be given sufficient attention. This result is consistent with Sulaiman [8], who stated that in the context of Malaysia, the science curriculum has objectives and goals based on the formation of attitudes and values. In addition, the capabilities of science lecturers can also emphasize knowledge and support the concept of the pedagogical process.

Effect of the Relationship Dimension of Input on Products in the PISMP Science Curriculum by TTC Science Lecturers

The results showed that the dimension of input affects the product dimension in the implementation of science curriculum in Malaysia. This means that the dimension of input is important to achieve a good product in the implementation of the science curriculum. This study is consistent with the study of Ahamad [24], which asserted that the dimension of input indicates a high level of achievement and affects the results of curriculum implementation.

Moreover, the results also show that all the elements of the content of knowledge, pedagogical skills, assessment and evaluation, and the selection of teaching and learning resources, contribute significantly to the input dimension. Nevertheless, the elements that contribute most significantly to the dimension of input in the implementation of the science curriculum are the selection and use of teaching and learning resources. The elements that contribute the least to the dimension of input are assessment and evaluation. This connotes that the elements of assessment and evaluation need attention in order to improve the input requirements. Meanwhile, the elements of the selection and use of teaching and learning resources should be preserved because these elements are very important in designing good input for the implementation of the science curriculum.

Next, the results also show that out of five factors, there are only two factors that contribute significantly to the element content of knowledge. These factors apply the content to be taught in science lessons and translate the content that will be taught in science education. This indicates that both factors play an important role in finding content for good teaching. However, the factor that contributes the least to the content of knowledge element is translating the content to be taught in science lessons. Therefore, these factors need to be addressed in order to formulate the content of knowledge in teaching as input in the implementation of the science curriculum.

Three of the five factors significantly contribute to the elements of pedagogical skills. These three factors are using diverse science teaching methods to enable students to use thinking skills, employing diverse approaches to the same topics in teaching science, and applying various activities to improve students' understanding of science teaching. These factors constitute very important elements in forming the pedagogical skills that support lecturers' input dimensions in the implementation of the science curriculum. This is also consistent with the finding of Yueh-hsia Chang [25] that the pedagogy of a teacher is very important in determining the teaching programs. Thus, the application of a variety of factors in instructional activities to enhance students' understanding of science provides a small contribution toward obtaining better pedagogical skills.

Only three of the nine factors contribute significantly to the elements of evaluation and assessment. These three factors are reviewing students' work to assess students' understanding, administering tests and examinations to assess student understanding, and providing scientific tasks to students. These three factors are very important in shaping the element of evaluation and assessment as input in the implementation of science curriculum. However, the factor that contributes the most to the smallest factor is providing scientific tasks to students. This means that the provision of scientific tasks to students should be strengthened further to improve the evaluation and assessment.

Only two of the five factors contribute significantly to the element of the selection and use of teaching and learning resources. These factors can be exchanged with other alternatives if there are insufficient scientific reference sources and the use of diverse sources for teaching and learning. This shows that these two factors are very important in the selection and use of teaching and learning resources as part of the dimension of input in the implementation of the science curriculum. The factor that contributes the least to the selection of the teaching and learning sources is the utilization of teaching and learning resources. Therefore, these factors need to be addressed to improve the lecturers' techniques in selecting and using resources in teaching and learning in the science curriculum.

It can be concluded that there are ten factors that are very important in shaping the dimension of input in the implementation of science curriculum. All these factors should be implemented in order to obtain beneficial input that will influence the implementation of the science curriculum product.

Influence of the Process Dimension on the Relationship to Products in the Implementation of the Science Curriculum by Science Lecturers

The results show that the process dimensions affect the product dimensions in the implementation of the science curriculum. This indicates that the process dimensions are important to achieve a good product in the implementation of the science curriculum. It also proves that when the process dimensions are improved, the product dimensions can be enhanced as well. This is consistent with the findings of previous studies [26] that the learning process affects the outcome of the product, the context of the curriculum goals and the pedagogical input into the learning itself. However, the learning process should be supported by the approaches or strategies used by teachers or lecturers such as the use of computer technology and other support in learning. Next, according to Jamil [27], the process of ascertaining the dimensions of the efforts that are made by relevant parties such as the State Education Department and the District Education Office is effective and could improve the knowledge of instructors in implementing a newly introduced program.

The results also illustrate that four elements, namely the implementation of teaching and learning based on knowledge of the content, the implementation of pedagogical skills, the implementation of assessment and evaluation, and the implementation of the selection and use of teaching and learning resources, provide a significant contribution to the process dimension of science curriculum implementation. Nevertheless, the elements that contribute the least to the process dimension are the elements of the selection and use of teaching and learning resources. Therefore, in implementing the science curriculum, lecturers should further improve their abilities in the selection and use of teaching and learning resources.

Moreover, the results show that two of the five factors of pedagogical skills contribute significantly to the implementation of the process dimension. These factors are the use of diverse science teaching methods to enable students to use thinking skills and the application of diverse teaching approaches to the same topics in teaching science. The factor that contributes the least is the use of diverse teaching approaches to the same topics in teaching science. This indicates that this factor should be further enhanced to improve its contribution to the implementation of this pedagogy. This factor is in line with the findings of Yueh-hsia Chang [25], who concluded that the pedagogy of teachers can determine the success of instructional programs.

Moreover, two of the seven factors contribute significantly to the assessment and evaluation of the

process dimension of curriculum implementation. These factors are identifying the weaknesses and strengths of science students' assignments and evaluating students' understanding. However, the factor that contributes the least is reviewing students' work to assess students' understanding. This factor should be improved further to support the implementation and evaluation of the lecturers.

For the implementation of the selection and use of teaching and learning resources, only two of the five factors contribute significantly during the process of the implementation of the science curriculum. These factors are the use of other electronic media as science teaching and learning resources, and finding alternatives if there are insufficient scientific references. The factor of seeking alternatives if there are insufficient scientific resources provides a small contribution, and thus, lecturers should give more attention to it in an effort to increase its contribution.

CONCLUSION

In the current study, the model shows that the framework of Context, Input, Process and Product (CIPP) can be used to obtain information to improve the implementation of curriculum, including science curriculum. The model's results show that context, input and process influence product innovation in curriculum implementation. This means that the better the context, input, process and implementation of a curriculum, the better the product.

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