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Using CBAM to Evaluate Teachers' Concerns in Science Literacy for Human Capital Development at the Preschool

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Abstract: The most important variable in human capital development is education and training. To facilitate Malaysia's transformation into a developed nation by the year 2020, a well-educated and trained workforce with relevant knowledge and skills especially in science and technology must be prepared. The Education Development Master Plan (2001-2010) identified human capital development as a major thrust, with an emphasis on science and technology in order to produce competent, innovative and creative manpower. The purpose of this study is to evaluate teachers' concerns in implementing science literacy among preschoolers using the newly introduced National Preschool Curriculum Standards beginning in 2010. The Concerns-Based Adoption Model (CBAM), was used to identify teachers' stage of concerns (SoC), the levels of use (LoU) and the innovation configuration (IC) of the curricular change. A mixed methods approach of data collection was used in the study. This article reports a quantitative approach using the survey method involving 385 preschool teachers. Descriptive statistics namely, frequency count and mean and standard deviation were used to analyze quantitative data. Analysis of the survey data indicated a significant difference in the stage of concerns (SoC) among teachers based on location of schools (urban/rural) and academic qualifications (graduate/non-graduate). The findings of the study point to the importance of intervention programs supporting teachers to get through the curricular change as developed by relevant authorities to ensure policy success in human capital development.

Key words: Human capital development · Curricular change · Science literacy · Concerns-based adoption model

INTRODUCTION

A well-educated and trained workforce is critical in nation building. In the Malaysian context, education plays the vital role in national development plans to meet manpower needs in all sectors of development. The Ninth Malaysia Plan (2006-2010) and the Education Development Master Plan (2001-2010) have focused on human capital development to transform Malaysia into a developed nation by the year 2020. Government allocations have increased substantially for research and development, especially in science and technology as well as for the development of intellectual human capital. The 2010 budget saw a total of RM30 billion being allocated to enhance primary and secondary education nationwide. Government expenditures on education and training as a representative of human capital variable were significantly related to economic growth domestic product [1].

Various initiatives have been undertaken to facilitate Malaysia's preparation to produce human capital with relevant knowledge and skills. In the school education sector, curricular innovation is being introduced at all levels of schooling. At the preschool level, a new curriculum was introduced beginning in 2010. The National Preschool Curriculum Standards (NPCS) is mandatory for all preschool centres, both public and private. The curriculum is organized using standard content and standard learning processes appropriate for the age level of four- to six-year-olds. The teaching and learning process is meaningful, using activities that make

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learning fun for the children. Child-centred inquiry and discovery learning using project work will provide children with sufficient acquisition of basic concepts and skills, self–confidence and positive attitudes in preparation for primary schooling. The NPCS is based on six strands or areas of learning: communication; spiritual, attitude and values; humanism; self-efficacy; science and technology literacy; and physical and aesthetics development. The six strands or learning areas will be extended to the first two years of primary school curriculum to ensure continuity [2]. To prepare teachers for implementation of the NPSC, in-service trainings were conducted to expose teachers and school administrators to the curricular changes.

The study of concerns has attracted a great deal of attention due to the presumed link between the levels and types of individuals' concerns as well as the successful implementation of innovations and reforms. The conception of a concern by [3] as the composite representation of the feelings, preoccupation, thought and consideration given to a particular issue or task includes the mental activity composed of questioning, analyzing, reanalyzing, considering alternative actions and reactions and anticipating consequences. Thus, teachers' concerns on educational changes and curricular reforms can be described as their feelings, thoughts and reactions in regards to new programs and innovations that they are required to adopt in their work environment. The level and type of teachers' concerns exert a powerful influence on the implementation of educational change as their perceptions and actions determine the success of the innovations. The significance or meanings that teachers attach to the curricular innovations stem from the reactions to the innovations and the possible problems associated with these reactions [4].

The CBAM is a model used to evaluate curricular innovations and reforms. It is a client-centred approach that demonstrates how individuals affected by change react to the implementation of the innovations [3]. The CBAM identifies seven Stages of Concerns (SoCs). In Awareness (Stage 0), teachers may be aware of the new program and have a little knowledge of it, but have no interest in taking any actions. In informational (Stage 1), teachers are aware and express interest in learning about the nature, aspects and requirements of the innovations; they may also pose questions and show willingness to learn more about the innovations. In Personal (Stage 2), teachers begin to focus on the impact the innovations will have on them and raise issues about how the innovations will affect them at the personal level, their own limitations and the changes they are expected to make. George and Stiegelbauer [5] categorized stages 0, 1 and 2 as personal or self-concerns. In Management (Stage 3), teachers' concerns focus on the processes and tasks of using the innovations; they express concerns about organizational details of the implementation and how to overcome problems and difficulties. In Consequences (Stage 4), teachers are concerned with the effects of the change on their students. Stages 3 and 4 are known as task-concerns. If positive impacts are observed, teachers are likely to continue to work for the implementation. In Collaboration (Stage 5), teachers are engaged in communicating and relating what they are doing and what their colleagues are doing. Finally, in Refocusing (Stage 6), teachers consider alternative ways and ideas that would be better for continued improvements of the innovations. Stage 5 and 6 refer to teachers focused on impact concerns.

The level of use (LoU) tool assesses how teachers are actually using the innovations. The eight LoUs are almost congruent to the SoCs. The eight LoUs are non-use, orientation, preparation, mechanical, routine, refinement, integration and renewal. Information on the LoUs is obtained through observations of classroom processes as well as interviews and conversations with teachers. Finally, innovation configuration (IC) tools are used to identify patterns of the innovations that result when different teachers implement the innovations in their own classrooms [6].

Beginning in 2010, the Ministry of Education (MoE) introduced the National Preschool Curriculum Standards (NPCS) nationwide. In line with the National Philosophy of Education, the NPSC focuses on the holistic and balanced development of the child to prepare him/her to be a young learner with positive attitudes towards learning as well as acquire sufficient basic skills in preparation for primary schooling. The curriculum focuses on standard content and standard learning processes. Standard content is defined as specific statements on aspects that a child should know and be able to do at a specific point of schooling. These aspects consist of knowledge, skills and values. The standard learning process is defined as specific criterion or indicator of achievement in the form of behavioural objectives that ensure the mastery of standard content. The curriculum adopts a modular approach of teaching and learning

namely, the Basic Module and the Thematic Module. The Basic Module consists of four components: languages (Bahasa Melayu, English, Chinese, Tamil), mathematics, physical and health education and Islamic education/moral education. The aim of the module is acquisition of mastery in early 4R (i.e., reading, writing, arithmetic and reasoning) literacy. Time allocated for teaching and learning of the Basic Module ranges from 35% at the beginning of the school year to 50% at the end of the year. Meanwhile, the Thematic Module consists of all learning strands in the curriculum. Teachers can develop themes suitable for the students, locality and events. Examples of suggested themes include my country, exploring the living world and exploring the physical world. Time allocated for teaching and learning the Thematic Module ranges from 0% at the beginning of the school year to 50% at the end of the year [2].

In the NPCS, mathematics and science literacy is emphasized through the learning standards in the science and technology strand. Since the emphasis of the current curricular change is acquisition of arithmetic skills, the learning of mathematics falls within the Basic Module, with time allocation of 40 minutes per week. As such, mathematics is taught as a subject at the preschool level. The standard contents include pre-number concept, number concept, mathematical operation (addition and subtract), value of money, time concept, space and shape. The learning outcomes listed in the curriculum documents include children i) showing increasing interest and awareness of numbers; ii) recognizing and naming common shapes; iii) showing increasing ability to match, sort and regroup objects according to shape, size and colour; iv) using language to compare a number of objects with terms such *more*, *less*, *few* and *greater than*; and v) showing progress to use standard and non-standard measures of length and area of objects. As for science literacy, the focus is on the acquisition of scientific knowledge and science process skills. The learning outcomes listed for the acquisition of scientific knowledge are expand knowledge and abilities to observe, describe and discuss the natural world, living and non-living things and the natural processes. For science process skills, the learning outcomes are to i) use senses and simple tools to gather information, investigate materials and observe processes and relationships and ii) describe, discuss, explain and make predictions based on experiences and observations [2].

Given the importance of science and technology in human capital development, it is considered to be appropriate that the study focuses on the science literacy component of the NPCS. The investigation of teachers' concerns in the implementation of science literacy is expected to provide information on the degree to which preschool teachers are capable of effectively implementing the new curricular change as planned by the MoE. The study of teachers' concerns can also facilitate the planning of programs and supports aimed at sustaining the innovations and meeting teachers' relevant needs. More importantly, findings of this study can provide avenues for policy-makers and educational leaders to acknowledge and identify the concerns of preschool teachers in order to increase the prospects of success for educational reforms. The aim of the present study is to identify and examine the concerns of preschool teachers about the curricular change in preschool education. Therefore, the specific objectives are i) to determine teachers' stages of concerns in teaching early science at preschool and ii) to identify teachers' concerns in teaching early science based on demographic variables of school location (rural/urban) and academic qualifications (graduate/non-graduate).

METHODS

The present study employed a mixed method of quantitative and qualitative approaches for data collection. For the quantitative approach, participants included 369 preschool teachers from MoE preschool centres. The teachers were selected from the national type of primary school (Sekolah Kebangsaan) in the Klang District. These preschool centres were chosen according to their location and demographic characteristics (rural/urban). The sample included a group of teachers dispersed across the whole range of age, teaching experiences and involvement in curricular innovations. For the qualitative approach, the case study method was used. A total of eight teachers (N=8) were selected from the survey group for in-depth study of LoU and IC.

The study used the stages of concern questionnaire (SoCQ) developed by George and Stiegelbauer [5]. However, in this study, the SoCQ was adapted and translated into Malay language (with the authors' permission) to suit the conditions and context of the Malaysian education system. The instruments consisted of 35 items categorized according to the six stages of

concerns. Teachers rated the 35 questionnaire items using a 7-point scale of intensity, ranging from 0 (not related) to 7 (very high). In an attempt to retain the original structure of the SoCQ and ensure that the instrument maintained acceptable reliability and validity, the adapted questionnaire was piloted to 64 respondents. Cronbach's alpha was used to examine the seven scales representing the different stages of concern. Analysis of the pilot test showed that the Cronbach's alphas for all stages were sufficiently high (0.89). The index of reliability for all stages of concern fell within the range of alpha 0.86 to 0.92. The values of the alphas indicate that the instrument has acceptable reliability for the sample of the study.

Table 1 explains the procedure for data collection and data analysis used in the study. For research question 1, descriptive statistics of frequency count, mean and standard deviation were employed. The scale of intensity was set at 1.00-2.40 (very low); 2.41-2.80 (low); 2.81-4.20 (average); 4.21-5.60 (high); and 5.61-7.00 (very high). For research question 2, a two-way ANOVA was used to explain differences in teachers' stages of concern based on the demographic variables identified in the study.

RESULTS AND DISCUSSION

Teachers' Concerns: Figure 1 summarizes the analysis of teachers' stages of concern in implementing the teaching of early science at the preschool level.

The mean responses of the 385 teachers to the scale (4.32 – 4.97) showed they were well acquainted with the new curricular change in preschool education. The total highest mean level occurred in the personal stage (4.97),followed by the consequences stage (4.82) and the information stage (4.77). The highest means at the personal, information and consequences stages describe the worries of teachers and feelings of uncertainties about their roles in the process of adopting the innovation. Teachers are aware of the changes required and expressed

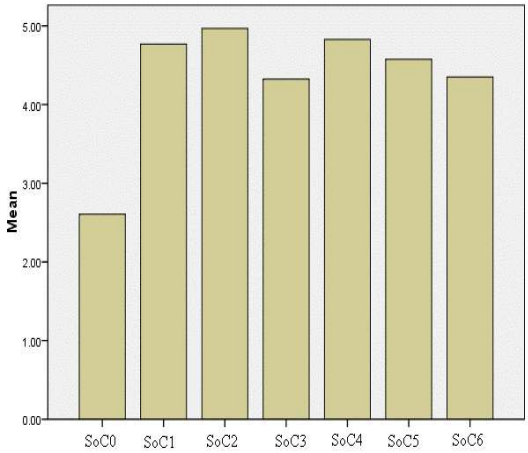

Fig. 1: Bar chart Stages of Concerns

a desire to learn the nature of the innovation and consider adopting the changes. At this stage, teachers may raise questions such as what the changes are and how are they different from previous practices. Issues are also raised regarding the potential benefits of adoption. Possible personal conflicts might arise as a result of the adoption. The higher mean of the consequences stage suggests that teachers are concerned about the impact of the innovations on their pupils as well as their performance in classrooms.

The low values in the management (4.32), collaboration (4.57) and refocusing stages (4.34) indicate that the teachers were more concerned about ways of accomplishing objectives, getting materials and covering the content of curriculum in the set time limits. The results suggest that teachers were more concerned about ways in which to deal with their daily teaching and learning practices. Individuals move through stages of implementation in a developmental pattern [7]. They first focus on self-stage concerns, then move on to task stage concerns and finally impact stage concerns. The findings of the current study appear to support the developmental

Table 1: Data Analysis According to Research Questions

	Research Question	Procedure	Data Analysis
1	What type of concerns do teachers have in implementing the teaching of early science?	Questionnaire 385 samples	Frequency, Mean Standard Deviation
2	Do significant differences exist in the teachers concern based on the demographic variables of school location (rural/urban) and academic qualifications (non-graduate/ graduate) in teaching early science?	Questionnaire 385 samples	Univariate Analysis of Variance ANOVA (Two Way ANOVA)

Table 2: Univariate Analysis of Variance ANOVA (Two Way ANOVA) Summary of Stages of Concern by School Location and Academic Qualifications

Demographic Variable	Stages of Concern	Sum of squares	df	Means square	F	*P*
School	Awareness	0.09	1	0.09	0.07	0.78
Location	Information	8.74	1	8.74	11.91	0.00
(A)	Personal	10.45	1	10.45	13.69	0.00
	Management	6.19	1	6.19	8.06	0.00
	Consequence	5.92	1	5.92	9.91	0.00
	Collaboration	8.98	1	8.98	11.54	0.00
	Refocusing	5.98	1	5.98	6.25	0.01
Academic Qualification (B)	Awareness	1.48	1	1.48	1.11	0.29
	Information	0.74	1	0.74	1.01	0.31
	Personal	0.62	1	0.62	0.81	0.36
	Management	1.79	1	1.79	2.33	0.12
	Consequence	1.34	1	1.34	2.25	0.13
	Collaboration	0.38	1	0.38	0.48	0.48
	Refocusing	0.05	1	0.05	0.05	0.81
A and B	Awareness	0.90	1	0.90	0.67	0.41
	Information	3.04	1	3.04	4.14	0.04
	Personal	7.70	1	7.70	10.09	0.00
	Management	1.37	1	1.37	1.788	0.18
	Consequence	1.95	1	1.95	3.27	0.07
	Collaboration	4.85	1	4.85	6.24	0.01
	Refocusing	0.76	1	0.76	0.79	0.37

Significance level p= 0.05

nature of concerns in the implementation of curricular innovation of early science. The results indicate that teachers' concerns are largely focused on the self and task stages. This stage of concerns in the implementation of curricular change is defined as the "zone of enactment" which emphasizes the efforts of teachers to operationalise the ideas introduced by the innovation [8]. By implication, the teachers involved in the current study are in Spillane's "zone of enactment" as they are in the early stages of implementing the new curriculum. Teachers are the agents of the implementation of government policy in the education sector and play a vital role in the success of policy initiatives. As implementers of government policies, teachers are expected to possess the knowledge, information and capabilities to meet the demands of the innovation. Highly motivated teachers are the real valuable asset of the school system since they can identify goals they want to accomplish focus on things they would like to change or achieve [9]. It can be expected that the impact stage concerns will grow at a later stage of the implementation process.

Differences in Teachers' Concerns Based on School Location and Academic Qualification: In the present study, it was hypothesized that school location and academic qualifications influence the movement of teachers from one stage of concern to another. Based on the CBAM, it was expected that teachers with higher academic qualifications than a bachelor's degree would indicate a shift from self-concerns to task concerns and from task concerns towards impact concerns as a result of their knowledge and experiences when compared to non-graduate teachers. It was further hypothesized that teachers in urban areas would demonstrate higher impact concerns towards the curricular innovations when compared to their colleagues teaching in rural areas. Table 2 summarizes teachers' responses in terms of their school location and academic qualifications.

However, the findings do not support the hypothesis. The results of the analyses showed no significant differences in teachers' concerns towards the innovations irrespective of places of teaching and qualification. As shown in Table 2, no significance differences occurred in teachers' concerns across school location and academic qualifications for the management (F=1.78; dk=1, 38; p=0.18), consequence (F=3.27; dk=1, 38; p=0.07) and refocusing (F= 0.79; dk=1, 38; p=0.37) stages. However, some significant differences were observed for the personal (F=10.09; dk=1, 38; p=0.00), information (F=4.14; dk=1, 38; p=0.04) and collaboration (F=6.24; dk=1, 38; p=0.01) stages. The results of the univariate analysis based on school location revealed significant differences among teachers in urban and rural areas in the personal (p=0.000), information (p=0.00), collaboration (p=0.00), consequence (p=0.00) and management (p=0.00) stages (Table 2). The results suggest that teachers in urban areas

exhibited higher self-concerns and task concerns on the innovations when compared to their rural colleagues. Teaching in urban areas requires teachers to be more prepared, especially when dealing with parents of children from high socioeconomic background and those parents who are concerned with their children performance.

With regard to academic qualifications, the analysis showed no significance between graduate and non-graduate teachers. The low values during the collaboration (p=0.48) and refocusing (p=0.81) stages suggest that teachers have similar concerns about ways of accomplishing objectives, getting materials, covering the content of curriculum and addressing practical problems in implementing the changes. Their preoccupation with the daily instructions and practices apparently made teachers less worried about concerns related to alternative ways of implementing innovations, collaborating with other colleagues and coordinating of their work. Success of any curriculum change or reform is highly correlated with how it is enacted at the classroom level. Many new curricular changes have failed to be implemented due to a lack of the knowledge and skills necessary among those involved in delivering the new curriculum [10, 11]. The NPCS consists of many new ideas that teachers need to acquire and the curriculum is still in the early stage of implementation. Curriculum reforms may be fragile and transient and educational planners should develop programs and support for teachers [12].

CONCLUSION

The results of this study showed that, in general, teachers are well acquainted with the new curricular change in preschool education. However, a closer look revealed teachers' concerns focused on the self-concerns and task -concerns, indicating that they are more oriented towards planning instructions and the daily routine of classroom teaching and learning processes. The lowest mean score on the management, collaboration and refocusing stages exhibited by teachers showed that their attention is more focused on the processes and tasks required in implementing the new curriculum. Most teachers involved in the study seemed to focus on the implications of the curricular change. They were largely interested in the changes related to their personal work. It is possible that they will shift to the impact concerns as they become more involved with the innovation, especially if the adoption of the innovation is systematically supported through professional development.

The analysis of the stage of concerns across groups of teachers involved in the current study did not reveal significant differences among teachers in terms of their school location and academic qualifications. Irrespective of their school location and academic qualifications preschool teachers reported similar stages of self-concerns and task concerns rather than impact concerns.

The results of the current study highlight the importance of attending to teachers' concerns with respect to the new ideas and changes in the delivery in the classrooms. The differences found in the study can be used to plan intervention programs to support teachers through the innovation and shift to higher levels of task concerns. In the absence of professional development and effective support, the possibility exists that teachers' stage of concerns will not progress from task to impact concern stages. Progression to higher levels of concerns may be halted as task concerns intensify, encouraging teachers to return to self-concerns. It is the responsibility of educational planners and policy-makers in this case the Ministry of Education and Curriculum Development Division to take actions that increase the prospects of success for the educational innovations and meet the creation of human capital required by the nation.

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