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Development of Rusnani Concept Mapping (RCM) Protocol Guideline on Academic Performance of Diploma Nursing Students

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ABSTRACT

Introduction: Concept mapping is an innovative teaching learning strategy for students who have the ability to develop concept maps. A planned and well-developed concept mapping protocol is needed, so that nursing educators have a teaching guideline, enabling them to improve their teaching techniques through concept mapping. Therefore, the researcher seeks to develop and validate the impact of the Rusnani Concept Mapping (RCM) protocol guideline for application among nursing students. **Objectives:** To develop, validate, and test the reliability of the RCM protocol guideline. **Methods:** The development of RCM based on Mohd Afifi Learning model (MoAFF), ADDIE model and integrating with Kemp model. This model protocol has five phases: analysis, design, development, implementation and evaluation. The validity of the protocol was determined based on content and face validity and the Delphi technique. The content validity of this lesson plan was established through expert review, involving seven expert panels. **Results:** After obtaining feedback from the expert panel, the researcher analysed content validity, using a formula based on percentages. This formula suggested that good content validity is indicated by a percentage of content validity achievement greater than 70%, whereas if the percentage of content validity is below 70%, it is advisable to recheck the content, according to the study objective. **Conclusion:** The reliability of the protocol was 0.816, showing that the RCM protocol has high reliability and validity. RCM is thus a positive and innovative teaching method that could be helpful in improving the academic performance of nursing students.

Keywords: *Development, Rusnani Concept Mapping (RCM), Academic performance, Nursing students*

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INTRODUCTION

Nurse educators are the main driving forces instilling interest in nursing students to learn. Educators might be successful in teaching the basics, but this does not mean that students will be able to analyse and evaluate what they are taught. There is a need to understand the complex processes involved in critical thinking. That why how important to the success of delivering the teaching and learning process. Therefore, it is extremely important for the teacher to understand about learning skills practiced and its role among the students during learning process in their respective classes. An understanding of student learning skills is important as a predictor of academic achievement (1). One method that educators can use is concept mapping. Rusnani Concept Mapping (RCM) is one of the teaching learning methods to lay down guideline for nurse educators to unitize the methods in the classroom and clinical setting. In studying under the RCM method, students are allowed to think critically, be creative and innovative and properly apply learning in the classroom to the clinic. It is hoped that this study will provide guidance in learning using concept mapping as a learning approach. Furthermore, with the use of colorful graphics and engaging students in learning as well as facilitate the use of a slide presentation educators to use in the classroom. RCM can also function as a guide for nurse educators because it is flexible and can be applied to all teaching topics. New teaching methods must be developed and implemented by nurse educators to assist students in thinking critically, understanding complex relationships, integrating theoretical knowledge into nursing practice, and becoming lifelong learners (2). Better educated nurses with complex skills and abilities are required to deliver safe, quality patient care in a health care system that is continually changing (3).

PROBLEM STATEMENT

Nurse educators are continually seeking methods that will enhance or improve critical thinking skills. For years, nurse educators have struggled to find theories and methods that can facilitate student learning as the health care system grows more complex and challenging. In improving patient acuity and safety, the movement of patient care from acute care facilities to community settings and the rapidly changing health care environment have increased the demand for nurses who are competent and can think critically. However, the problems for nurse educators now are how to encourage students to engage in analytical thinking and how to make the analytical thinking process part of their daily practice.

Owing to its exam orientation, the traditional didactic approach is not in step with the nation's mission of preparing students to be creative and critical thinkers. The traditional approach has led students to engage in less critical thinking, thus learning each subject merely for examination purposes. This teacher-centred approach does not allow nursing students time to develop clinical judgement skills, problem-solving abilities, or nursing care skills (4). Under these conditions, long-term learning will not occur.

Therefore, when students are in the clinical field, they cannot perform well and be competent because they cannot relate the knowledge they had learn in didactic theory e.g. care of diabetes mellitus patient and relationship between concept and plan nursing care to their patients. Students may be unable to think outside the box due to the traditional method of learning. Thus, they become followers, as they do not know any better. Therefore, the researcher wishes to develop and test the impact of the Rusnani Concept Mapping (RCM) protocol in academic performance among nursing students. The RCM protocol provides guidance to lecturers of teaching and learning practices, where the concept of

mapping enhances student-centred learning and encourages innovation and creativity among students.

STUDY OBJECTIVES

1. To develop the RCM protocol guideline.
2. To validate the RCM protocol guideline.
3. To test the reliability of the RCM protocol guideline.

LITERATURE REVIEW

The RCM protocol guideline is one of the best methods of ensuring the smooth and effective delivery of learning. The validity of the module is determined based on the views of experts (5). A range of three to ten content experts is recommended in the literature for the content expert review needed in the content validation process (6, 7). Thus, a minimum of three experts, but not more than 10, are required by the researcher (8). The researcher must prepare some materials, such as letters of appointment, evaluation forms, a completed lesson plan and an explanation or instruction, before meeting the experts (7). Kemp, Morrison and Ross (9) stated that the questionnaire is a tool often used to evaluate perceptions. In this case, the perceptions evaluated are those of the experts of the RCM protocol.

Therefore, a questionnaire about content validity, a letter of appointment and brief description sheets were distributed to experts in the field. This evaluation phase is very important in the overall assessment of how the experts perceive the RCM teaching protocol. Therefore, for the purposes of this study, a lesson plan using concept mapping was developed. Additionally, four evaluators — two experts in the field of nursing education and two experts in teaching pedagogy from Universiti Sains Malaysia and the Institute of Teacher Education — were contacted through personal phone calls or emails to request their participation.

METHODOLOGY

Development of RCM Protocol Guideline

Stage 1: Development and Validation of the Rusnani Concept Mapping (RCM) Protocol Process

The RCM protocol guideline is based on the ADDIE model, a model that has five phases: analysis, design, development, implementation and evaluation. ADDIE is an acronym for Analysis, Design, Development, Implementation and Evaluation (10, 11, 12). Each phase is explained in detail, and a design module is based on the Mohd Afifi Learning model (MoAFF), as detailed by the Kemp model. MoAFF is illustrated in Figure 1. Three stages are involved in the development of RCM. In Stage 1 (development and validation of the RCM protocol process), steps one, two and three of ADDIE were combined (Analysis, Design and Development). The reason for the choice of the MoAFF model is that it includes phases of analysis, design, development, implementation and evaluation. The MoAFF model fits with the culture of learning and teaching in Malaysia because it integrates with the Kemp model, which is oriented towards teaching in the classroom. The Kemp model focuses on the classroom (13). In addition, the activities that are arranged, in accordance with the phases of the ADDIE model, facilitate learning among teachers and students in ways that are attractive and flexible.

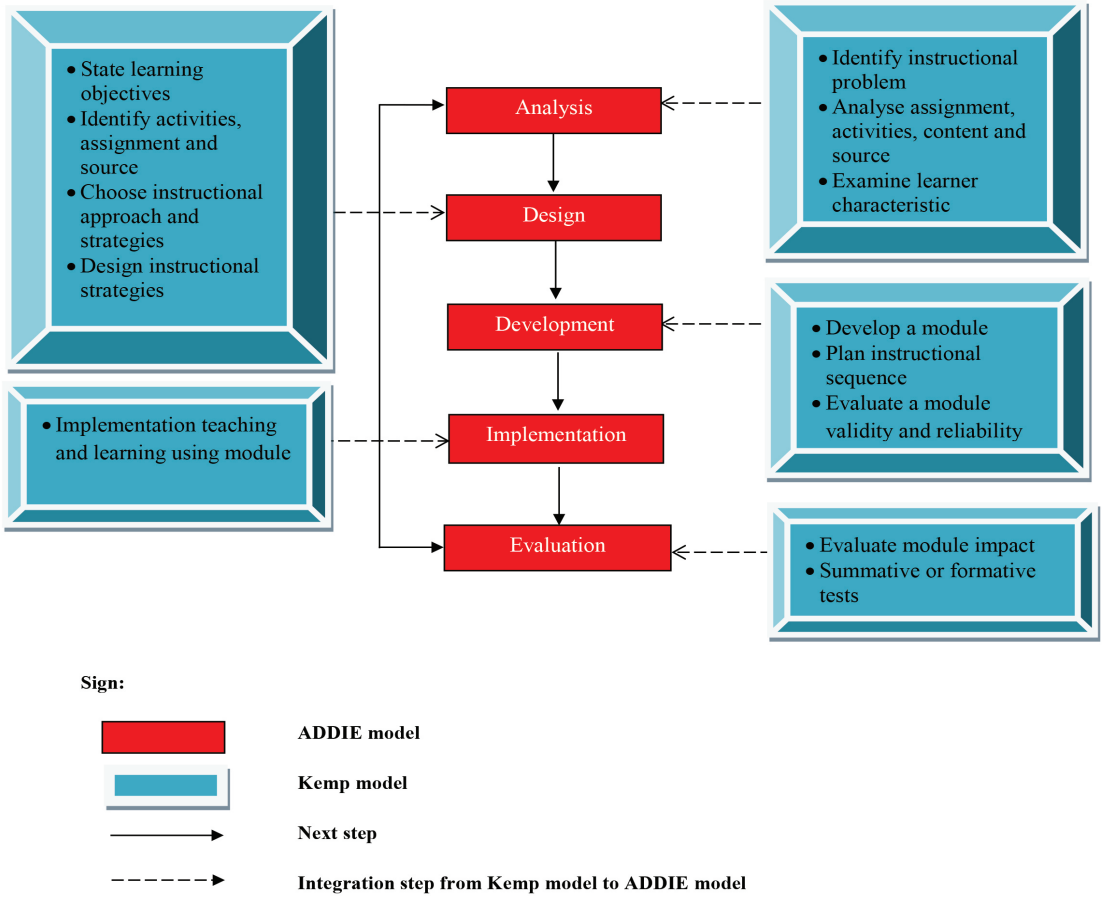

Figure 1: Mohd Afifi Learning model (MoAFF).

Analysis Phase

The analysis phase is the foundation of all the other phases. The researcher must define the problem, identify the cause of the problem and determine its solution. The analysis phase also includes identifying the type of learning involved and the learner characteristics, such as academic background and academic achievement (GPA). The analysis should reveal characteristics of students, such as the sex ratio and the student's ability level (14). In this study, based on the MoAFF model, the researcher identifies the following:

a. The target group

   Nursing students in Semester Four (Year 2 Semester Two) were selected.

b. The nurse educator

   Taking into account the needs of the nurse educator, this protocol provides alternative learning activities that can be used in teaching.

c. Selection of the title topic to be taught

   The researcher chooses to prepare a lesson plan in which RCM is applied to the topic of Medical Surgery in diabetes mellitus.

Design Phase

In this phase, the researcher must state the learning objectives, the learning approach and the set learning activities. The researcher has chosen concept mapping as the main approach to teaching and learning. Researcher states the learning objectives such as students will develop their concept

mapping skills; students can create their own concept mapping at the end of teaching and learning process in subject of diabetic mellitus. Kemp, Morrison, and Ross (9) have suggested that the learning content sequence efficiently is critical to helping consumers or students to achieve the objectives.

Development Phase

In this phase, researcher develop RCM protocol with consists of lesson plan using concept mapping with is consist of assignment (case study based on the scenario) exercise (Concept mapping notes), give Multiple Choice Questions (MCQ) pre and posttest to the students regarding topic that have been taught and evaluate the students' performance at clinical practice using concept mapping structure.

Stage 2: Validation Process

In this phase, a validation process is undertaken before the implementation phase. Validity and reliability are important in the quantitative study to determine the suitability of the instrument (15).

Validation of Content RCM (Didactic Theory)

Two types of validity must be assessed: content validity and face validity.

a. Content validity

Content validity refers to the extent to which the content can be used to measure what needs to be measured (16). It is used to determine the content representativeness of the content. Content validity in this lesson plan was established using expert review, involving seven expert panellists. The researcher appointed four experts with doctorate degrees from the education field to assess the content validity of the lesson plan and teaching methodology. To validate the content relating to diabetes mellitus, the researcher appointed three evaluators, two in the field of nursing education and two in teaching pedagogy, from Universiti Sains Malaysia (USM). In the review process, the experts were asked to read and judge how relevant the items based on the content domain were, according to a 5-point scale (1-Strongly disagree; 2-Disagree; 3-Neither agree nor disagree; 4-Agree; and 5-Strongly agree). The items included the following: the suitability of the target group; the suitability of time in conjunction with the objectives and procedures in an activity; whether the protocol content can improve participants' academic and personal achievements; whether the protocol can help change participants' attitudes towards excellence. The experts were encouraged to provide comments on each item, consider whether items should be modified or dropped, or suggest content that had perhaps been overlooked.

Calculating the content validity score

After receiving feedback from the four expert panellists on the lesson plan and teaching methodology, the researcher analysed the degree of content validity attainment, using the formula of Sidek Mohd Noah and Jamaludin Ahmad (17). The results are in percentage form (%). This formula suggests that if the percentage of content validity achievement is more than 70%, then it shows good content validity, and if it is less than 70%, then the results are not considered good, and it is advisable to recheck the content against the objective of study. The formula used was as follows:

$$\frac{\text{Total Score from Expert } (\chi)}{\text{Maximum Score } (25)} \times 100 = \text{Content Validity Achievement}$$

b. Face validity

Face validity, which refers to the assessment of a measuring instrument, is seen as a relevant measure that is suitable, unambiguous and clear (18). Several aspects must be assessed to determine face validity (18). Among these aspects is spelling, spacing between words, font size, instructions and the format used. The first process is conducted by asking the expert to assess the first draft that was developed.

Implementation Phase (Pilot Study)

An official letter was sent to the Director of the Kejururawatan Kubang Kerian Nursing College to obtain permission to conduct a pilot study. The pilot study was done at Kolej Kejururawatan Kubang Kerian among Semester Four nursing students because there are similar characteristic with the research plan. Twenty respondents were involved in this pilot study. The aim was to develop and test the adequacy of the research instruments. To establish internal validity, a pre-test/post-test instrument was implemented. In addition, the pre-test was implemented so that the researcher could investigate whether the concept mapping strategies "improved" the test scores.

The implementation stage reflects continuous modification of the programme to ensure that maximum efficiency and positive results are obtained. The pilot study was conducted in this phase, before the actual teaching and learning sessions occurred. The researcher provided a briefing and guidance to the nurse educator regarding the RCM protocol so that the nurse educator would be able to use it effectively. This learning session lasted two hours and was conducted using lesson plans from the RCM protocol.

Stage 3: Reliability of RCM Protocol

Stage 3 (Reliability of RCM process) involved step five of the ADDIE model (Evaluation phase).

Evaluation Phase

Various methods can be used to determine the reliability of a measurement tool (19). The most common methods are test-retest reliability, alternate form reliability, and internal consistency reliability (20). Cronbach's alpha is the most widely used method of testing the internal consistency of coefficients to establish reliability. Cronbach (21) states that one way to assess the reliability index of a module is the Cronbach alpha method. In this study, the researcher tested the validity of the measurement instruments in the RCM protocol using Cronbach's alpha. There exist no fixed standards established by local or foreign researchers regarding the best coefficient reliability value. The reliability module is considered good and acceptable when the index value is greater than 0.70 (16, 22).

A minimum reliability index value of 0.50 is acceptable as a module's reliability index value (22). According to De Vellis (23), there are five different alpha levels in scale development, namely, undesirable (between 0.60 and 0.65), minimally acceptable (between 0.65 and 0.70), respectable (between 0.70 and 0.80), very good (between 0.80 and 0.90), and possibly requiring shortening of the scale (above 0.90). A suggested criterion for acceptance of a newly developed module is an index value between 0.65 to 0.85 (24).

RESULTS

Validity and Reliability

(a) Results of Content Validity Guideline Protocol of Lesson Plan

Table 1 presents the results for content validity, based on the four expert panellists. Almost all the experts suggested that the lesson plan and teaching methodology must be provided in two languages (Malay and English). The researcher took note of this and incorporated it into the experimental study. Table 2 shows that the highest percentage was given by Evaluator 4 (96%), followed by Evaluator 3 (92%) and then Evaluator 2 (84%), with the lowest percentage given by Evaluator 1 (72%). Overall, all evaluators agree that the RCM guideline protocol is related to the objectives of the protocol guideline for teaching and is suitable to the target group. High validity may be attributed to items in the questionnaire that elicited mean values on the Likert scale of between 4 and 5.

Table 1: The content validation process of the RCM protocol for the lesson plan instrument by four expert panellists

Content validity question	Scale				
	1 Strongly disagree	2 Disagree	3 Neither agree or disagree	4 Agree	5 Strongly agree
	n (%)	n (%)	n (%)	n (%)	n (%)
The suitability of the target group	–	–	–	–	4 (100)
The content of this protocol can be implemented properly	–	–	–	2 (50)	2 (50)
The suitability of time in conjunction with the objectives and procedures of an activity	–	–	1 (25)	2 (50)	1 (25)
The protocol content can improve the participant's academic and personal achievements	–	–	1 (25)	2 (50)	1 (25)
The protocol content can help change participants' attitudes towards excellence	–	–	1 (25)	2 (50)	1 (25)

Table 2: Division of validity achievement, according to percentages given by four expert panellists

RCM protocol	Expert's score (x/25) × 100	Total of validity achievement (%)	Validity index
Evaluator 1	18/25 × 100	72	0.72
Evaluator 2	21/25 × 100	84	0.84
Evaluator 3	23/25 × 100	92	0.92
Evaluator 4	24/25 × 100	96	0.96

(b) Results of Content Validity of Diabetes Mellitus

Table 3 (i), (ii) and (iii) displays the results regarding the relevancy, accuracy and sufficiency of questions. The experts were contacted through personal phone calls or emails to determine their willingness to participate. In the review process, experts were asked to read and assess the items in terms of relevancy, accuracy and sufficiency, according to a 5-point scale (1-Strongly disagree; 2-Disagree; 3-Neither agree or disagree; 4-Agree; and 5-Strongly agree).

Table 3: Content validation process of the RCM protocol for the content of diabetes mellitus by three expert panels

i. Relevancy of questions

No	Relevancy of questions	%
1	Are the definition related to topic of diabetes mellitus relevant?	100
2	Are the etiology related to topic of diabetes mellitus relevant?	100
3	Are the pathophisiology related to topic of diabetes mellitus relevant?	100
4	Are the diagnostic investigation related to topic of diabetes mellitus relevant?	100
5	Are the clinical manifestation related to the topic of diabetes mellitus relevant?	100
6	Are the risk factors related to the topic of diabetes mellitus relevant?	100
7	Are the treatment of non-pharmacologic related to topic of diabetes mellitus relevant?	100
8	Are the treatment of pharmacologic related to topic of diabetes mellitus relevant?	100
9	Are the nursing diagnosis and intervention related to topic of diabetes mellitus relevant?	100
10	Are the health education related to topic of diabetes mellitus relevant?	100

ii. Accuracy of questions

No	Accuracy of questions	%
1	Are the definition related to diabetes mellitus accurate?	99
2	Are the etiology related of diabetes mellitus accurate?	100
3	Are the pathophisiology related to diabetes mellitus accurate?	100
4	Are the diagnostic investigation related to topic of diabetes mellitus accurate?	99
5	Are the manifestation clinical related to diabetes mellitus accurate?	100
6	Are the risk factors related to diabetes mellitus accurate?	100
7	Are the treatment of non pharmacologic related to diabetes mellitus accurate?	100
8	Are the treatment of pharmacologic related to diabetes mellitus accurate?	99
9	Are the nursing diagnosis and intervention related to diabetes mellitus accurate?	99
10	Are the health education related to diabetes mellitus accurate?	100

iii. Sufficiency of questions

No	Sufficiency of questions	%
1	Are the definitions related to the topic of diabetes mellitus sufficient?	99
2	Are the etiology related to topic of diabetes mellitus sufficient?	100
3	Are the pathophisiology related to topic of diabetes mellitus?	100
4	Are the diagnostic investigation related to topic of diabetes mellitus is sufficient?	99
5	Are the manifestation clinical related to topic of diabetes mellitus is sufficient?	99
6	Are the risk factors related to topic of diabetes mellitus sufficient?	99
7	Are the treatment of non pharmacologic related to topic of diabetes mellitus sufficient?	100
8	Are the treatment of pharmacologic related to topic of diabetes mellitus sufficient?	100
9	Are the nursing diagnosis and intervention related to topic of diabetes mellitus sufficient?	100
10	Are the health education related to topic of diabetes mellitus sufficient?	100

Results of Validation Analysis (Content of Diabetes Mellitus)

To assess the content validity of the subject of diabetes mellitus, the research questions were divided into three parts (see Table 4). In Part 1, on the relevancy questions, the highest percentages were given by Evaluators 1 and 2 (100%), followed by Evaluator 3 (80%). In Part 2, on the accuracy questions, Evaluators 1 and 3 gave 100%, followed by Evaluator 2 (72%). In Part 3, on the sufficiency questions, the highest assessment was given by Evaluator 1 (96%), followed by Evaluator 3 (80%) and Evaluator 2 (70%). Overall, all evaluators agreed that the RCM guideline protocol was relevant, accurate and sufficient in terms of the content of the subject of diabetes mellitus. High validity may be attributed to items in the questionnaire that elicited mean values between 4 and 5 on the Likert scale.

Table 4: Division of validity achievement, according to percentages given by three expert panellists

Relevancy of questions	Expert's score (x/50) × 100	Total of validity achievement (%)	Validity index
Evaluator 1	50/50 × 100	100	1.0
Evaluator 2	50/50 × 100	100	1.0
Evaluator 3	40/50 × 100	80	0.8

Accuracy of questions	Expert's score (x/50) × 100	Total of validity achievement (%)	Validity index
Evaluator 1	50/50 × 100	100	1.0
Evaluator 2	36/50 × 100	72	0.72
Evaluator 3	50/50 × 100	100	1.0

Sufficiency of questions	Expert's score (x/50) × 100	Total of validity achievement (%)	Validity index
Evaluator 1	48/50 × 100	96	0.96
Evaluator 2	35/50 × 100	70	0.7
Evaluator 3	40/50 × 100	80	0.8

(c) Validation of Concept Mapping Structure, Using Delphi Technique (Clinical Practices) and MCQ

The Delphi technique is a widely used and accepted method of gathering data from participants within a domain of expertise. The objective of this study is to discuss the process of the three rounds Delphi technique in seeking a consensus of concept mapping structure and MCQ in Diabetic Mellitus subject. There are ten experts panel involving in validated the concept mapping structure and MCQ questionnaire from USM, nursing lecturers from USM and Kolej Kejururawatan Kubang Kerian.

Using this technique, the experts were given the opportunity to consider the objections of other group members in an environment free from bias in which they were free to express their opinions. The Delphi technique was used to collect data. The validity of the survey was enhanced by the use of experts in the validation process (25, 26). The Delphi process can be continuously iterated until consensus is determined to have been achieved.

In the first round, participants were given a structured questionnaire on the concept mapping structure and the MCQ on the subject of diabetes mellitus. In the second round, the mean and median values of round one were added. In the third round, the mean and median values of round two were added. Participants were asked to rate the categorised responses from round one on a scale of 1 to 5, with 1 being "Very irrelevant" and 5 being "Very relevant". This technique does not require that participants be collocated or meet face-to-face, making it feasible to conduct surveys with qualified people over a wide geographic area. The feedback process allows and encourages the selected Delphi participants to reassess their initial judgements about the information provided in previous iterations.

Data were analysed to check for consistency in the experts' responses between rounds. An instrument developed based on the Delphi technique research findings was also examined and obtained validation from the experts with regard to content and construct validity. The analysis of the consensus data of the experts was based on median, inter-quartile and quartile deviations in the round 1, 2 and 3 data. In conclusion, the concept mapping structure and MCQ questions were found to meet consensus when all statements received a median consensus above 4, implying that the importance of the statements was high, while if the median value was less than 3.5, the importance of the statements was assessed as low. Therefore, the Delphi technique is an appropriate methodology for identifying the significant issues.

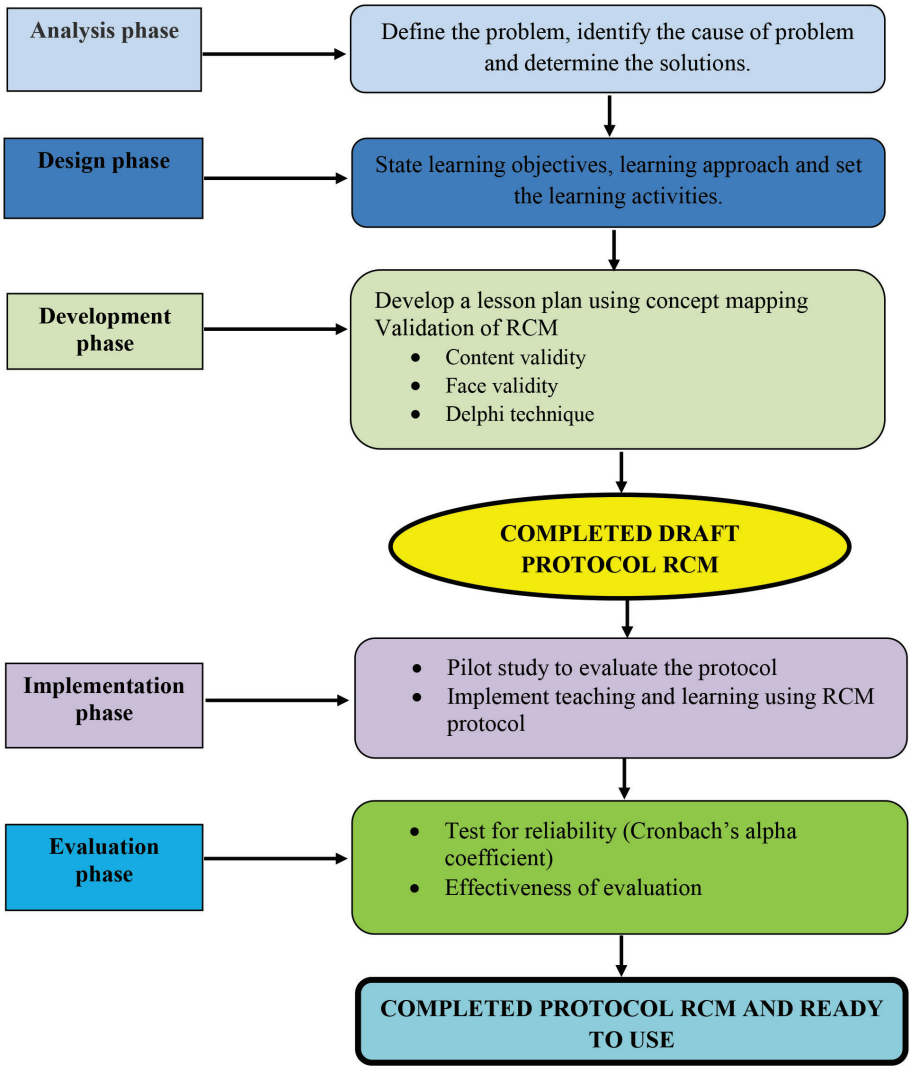

Figure 2: Flow chart of development of RCM protocol according to the phases of the ADDIE model.

DISCUSSION

The RCM protocol was developed in accordance with the phases of the ADDIE model. Each phase is explained in detail, and design modules are based on the MoAFF. The model is also well suited to the use of concept mapping teaching methods, as all the activities in its construction are student-centred, with an educator serving as the facilitator. All information and elements can be adjusted and are easy to modify to meet the needs of the curriculum and the learning objectives. The integration of this model with the Kemp model is very convenient, as it is oriented towards teaching in the classroom.

In this study, the content validity index was above 72%, confirming that the RCM protocol guideline has high reliability and validity. Validity coefficients of 0.70 or more indicate good validity of a test measurement instrument (27). Acceptable validity is indicated by a coefficient of 0.60, while a validity coefficient below 0.60 suggests that the measurement instrument is poor and needs improvement (19). The validity coefficient indicates that the RCM protocol guideline is applicable and is an effective teaching method for improving the academic performance of nursing students.

Content Validity Achievement

One method used to determine the content validity of a measurement tool is expert opinion (28). In this study for validity, Sidek Mohd Noah and Jamaludin Ahmad (17) confirming that the content validity when it meets the target population, the implementation of the module is quite satisfactory, the time that is in use is sufficient, it can increase the level of student achievement and can turn it lea will increase towards excellence. In this study, it is important to note that RCM fulfilled the protocol criteria set out by Sidek Mohd Noah and Jamaludin Ahmad (17). The majority of the panellists agreed that the content domains were represented within the guideline of the RCM protocol. In summary, the RCM protocol has high content validity and scored high on the Likert scale in a test of its validity. The findings show that RCM is an innovative method of learning that can motivate students and increase student interest in nursing.

Reliability of RCM Protocol Guideline

Based on the pilot study, testing of the RCM protocol guideline was calculated using Cronbach's alpha coefficient. Ten items were scored on a Likert scale of 1-Strongly disagree to 5-Strongly agree. The data were analysed using SPSS statistics Version 23.0 for Windows. Based on the data analysis, the reliability of the RCM protocol guideline was found to be 0.816. The minimum reliability index value of at least 0.60 is applicable (28, 29). In this study, the results indicate that the RCM guideline protocol has high validity and reliability.

CONCLUSION

In summary, the RCM protocol has high content validity, scoring high on the Likert scale in a test of its validity. In the data analysis, the reliability of the RCM protocol guideline was found to be 0.816. In addition, this protocol is expected to help nurse educators, especially at the Institusi Latihan Kementerian Kesihatan Malaysia (ILKKM). Overall, the design-based module, MoAFF, and the ADDIE model utilise systematic teaching modules to achieve learning outcomes. In addition, this model is flexible and non-linear, allowing researchers to adapt and combine it easily. Learning activities using the RCM protocol are student-centred, with the teacher acting as a facilitator. This tool can also be easily assessed because outcomes obtained through it are real products produced through concept mapping. This is where creativity, innovation, skills and a variety of other elements taught through hands-on learning can be seen through the concept mapping notes. Therefore, the researchers recommend that all nurse educators use the RCM protocol guideline in their teaching and learning in nursing education.

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