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Chemistry enrichment in tourism vocational school: The development and validation of food additives module

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Abstract. This study focused on the development and validation of the chemistry module in food additive topic for vocational students in the tourism field. An exploratory mixed method was conducted with four steps include qualitative, development, quantitative and interpretation. The Food Additives Module (FAM) was developed based on the basic competence of food processing and extended on chemistry content. To get the content and face validity, two experts had reviewed the FAM and gave the feedback to revise it. The analysis of FAM feasibility gained by the response of 7 chemistry teachers on four aspects includes the worthiness of chemistry concept, concept presentation, linguistics, and graphic. This study had produced the FAM module based on the contextual approach. The module had four theme namely sweeteners, preservatives, coloring and flavoring foods. A group of experts declared that the FAM was worthy as the chemistry enrichment content for vocational students of tourism field. The teacher gave a good response to the FAM quality. This study suggests that the FAM will be a useful tool for teachers to improve the chemical literacy of students in vocational tourism school.

1. Introduction

The objective of the vocational school was concerned to prepare the students in dealing with the working field. Hence, mostly students on vocational school, only focused on their specific expertise lesson instead of the other lesson. For example, in the tourism program, the students had less interest in studying the lesson outside their specific expertise such as chemistry. They feel that chemistry is not related to their specific expertise [1]. Moreover, the chemistry concepts were difficult to understand, has abstract characteristics, and not relevant to their daily life thus the students feel reluctant to learn chemistry [2]. These facts bring the decline of chemistry learning quality in the vocational tourism student. In fact, the chemistry learning is required as a prior knowledge in mastering the tourism specific expertise especially on the food processing topic. The sweeteners, preservatives, coloring, and flavoring food were the main materials in the food processing topic which were used chemistry as basic concept in understanding that topic. A learning source which provide the chemistry content with the context of tourism field is needed as a media of vocational tourism students in order to conduct a meaningful chemistry learning. The meaningful chemistry learning could be reached by correlating the chemistry concept with the daily life problem through the contextual approach.

Contextual approach may facilitate vocational tourism students in learning chemistry. Contextualizing the content of chemistry learning is potential to improve students' motivation, it is also reinforcing the meaning of learning chemistry and its perceptions [3]. The students tend to be more attracted in studying a big ideas of contextual discipline concepts than the fundamental concepts [4]. The used of contextual approach in chemistry learning facilitate the students to make a connection



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among the chemistry concepts with their daily life experience [5]. The contextual approach assumes that the students are naturally looking for the meaning of the learning context which appropriate with their daily life environment. Through the combination of the chemistry content with the students' daily experience could produce the meaningful understanding of the chemistry concept. The students could use their knowledge to solving some new and have never faced problems by increasing their knowledge and experience. Students are expected to be able in constructing their knowledge which be applied in the everyday life by combining the chemistry knowledge they got from the school. Thus, chemistry teacher should correlate the chemistry content with its usefulness in the students' daily life. Consequently, the students could apply their knowledge in chemistry toward the context of everyday life and bring the readiness in dealing their future working field.

The contextual approach brings the chemistry learning environment quite interesting. These learning approach lead the student understand that the tourism field is closely related to chemistry concept. They need to learn the differences of the natural and synthetic food coloring. They also learn on how and why giving natural or synthetic color to the food were safety to consume or not. The flavoring as additional materials to enhance the food taste. Which food preservatives was safety as additional materials and how much the threshold number of food preservatives to be add. These contextual problems were found in the everyday life which could be answer by the chemistry concept and bring the increasing of students' chemical literacy [6]. Hence, the used of contextual approach is needed to enhance students' chemical literacy due to the lack of Indonesian students' chemical literacy [7] especially in the vocational school.

The modification of teaching material on chemistry learning facilitate the students understand the chemistry concept easily, accurately, precisely, and clearly [8]. Consequently, a media which describe the food processing topic with the extend of chemistry content was needed in order to facilitate vocational tourism students in learning chemistry. The contextual approach in the term of daily life issues could be applied to develop several media in chemistry learning such as module. The module which used contextual approach will bring the increasing of vocational tourism students on chemical literacy. Hence, the chemistry meaningful learning will occur which implied the improving of the process and outcomes learning quality. Thus, this research was concerned to present the development and validation of the chemistry FAM for vocational students in the tourism field. These FAM was construct according to the contextual approach. Thus, the FAM was expected to improve chemical literacy of vocational tourism students.

2. Methods

2.1. Research design and procedure

This research aimed to develop and validate chemistry FAM based on contextual approach for vocational students in the tourism field. An exploratory mixed method design including the qualitative, development, quantitative, and interpretation steps were employed in this study. The research design present in the figure 1.

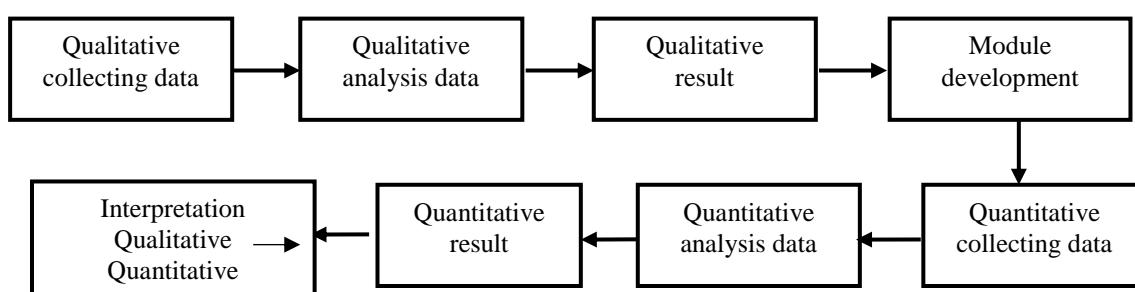


Figure 1. Exploratory mixed methods design

The qualitative step was aimed to analyze some problems on chemistry learning which occurred in the vocational tourism students. The result of this step showed that FAM was needed to enrich the knowledge of vocational tourism students. Whereas, on the development phase was aimed to provide a

solution of the problems were found on the qualitative step. The determination of learning sources as reference and contextual content framework were conducted on the development step. The layout and content development were compiled to construct the FAM. The content and face validation were obtained by asking a group of experts to review the FAM. Moreover, on the quantitative step was conducted by asking the responses from a total of 7 teachers on four aspects includes the worthiness of chemistry concept, concept presentation, linguistics, and graphic toward the FAM. Finally, on the last step was interpretation of the research results according to the three steps conducted before, the qualitative, development, and quantitative steps.

2.2. Data collection and research instrument

There were three type of instruments used to collect the data in this research, there were the qualitative, development, and quantitative instrument. The qualitative instrument consists of the guide of the interview and the basic competence analysis sheet. The instrument which was used in the development step covered the validation sheets. Moreover, the instrument used on the quantitative step was the teachers' responses sheet toward the FAM covering four aspects of chemistry concept, concept presentation, linguistics, and graphic. In this case, the teachers were requested to review the FAM and gives a score from 1 (indicated very poor) until 5 (indicated very good) on each indicator of the teachers' response aspect of the FAM. A total of 25 indicators of the teachers' response toward the FAM shown in table 1.

Table 1. Indicator of the teachers' response toward FAM

Aspect	Number of Indicator	Indicator
Chemistry concept	1	The content of FAM could develop the students' chemical literacy
	2	The deepness content of FAM was appropriate with the elaboration of the tourism vocational school basic competencies
	3	The extent content of FAM was appropriate with the elaboration of the tourism vocational school basic competencies
	4	The FAM has a correct chemistry concept
	5	The FAM has contemporary, factual, and actual characteristics
	6	The content about the food additives on FAM was relevant to the needs of vocational tourism students
Concept presentation	7	The presentation of the FAM content begin with the context of vocational tourism students
	8	The presentation of the FAM content conducted logically and systematically
	9	The FAM content presentation were communicative and easily understood
	10	The FAM content presentation equipped by an illustration of the picture
	11	The method in presenting the FAM content was consistent to facilitate students
	12	The FAM content relates to the application of the students' specific expertise
	13	The presentation on FAM content encourages the students' motivation to read, collecting information, and learn the chemistry concept
Linguistics	14	The sentence on the FAM was proportional and effective
	15	The language used on the FAM was easy to understand, unambiguous, and clear
	16	The language used on the FAM was communicative, interactive, and straightforward
	17	The writing rule on the FAM was appropriate with the correct Indonesian spelling, standard rules, meaning to be conveyed, and scientific terms
	18	The used of symbol or chemistry sign on the FAM were consistence
Graphic	19	The cover of the FAM on the front and the back was harmonious, attractive, and has sufficient color contrast
	20	The chapter titles, subtitles, page numbers, illustrations, figures title, and source images were compiled in complete, clear, and precise manner
	21	The FAM cover was reflects the contents of the book and was appropriate with the content characteristics
	22	The type and thickness of the paper were appropriate and the text were printed in a good and clear manner

Aspect	Number of Indicator	Indicator
	23	The types and font sizes were arranged proportionally, neat, and attractive
	24	The paragraphs, sentences, and words were appropriate in the term of the spacing and tracking
	25	The variation of the font types were not more than 3 types and those effects was not excessive.

2.3. Data analysis

There were two kinds of data collected in this research, the qualitative and quantitative data. The qualitative data were obtained from the vocational school teachers' interview in the term that FAM was needed to enrich the vocational tourism student knowledge and a group of expert in the term of suggestion and feedback of the FAM. The experts were reviewed the module according to several aspects including the chemistry content, the contextual approach integration, the presentation of the language and Indonesian grammar rules. These qualitative data were analyzed narratively. Required revisions were made according to the experts' feedback in order to enhance the quality of the module.

Whereas, the quantitative data in the form of teachers' response toward the module were analyzed according to descriptive quantity technique. The mean score given by the teachers on each aspect of the response toward the module were classified into five categories from very poor to very good. The range interval of the five categories used in this research consisting: a very poor category if the mean score less than 1.80; within the range of 1.81–2.60 indicated poor category; 2.61-3.40 indicated sufficient category; 3.41-4.20 signified good category; and very good category if greater than 4.20. Moreover, the ideal percentage on the fourth aspects of the teachers' response were calculated.

3. Results and Discussion

The development and validation of the chemistry FAM for vocational students in the tourism field has been conducted. The FAM was developed due to the result of teachers' interviews on the qualitative phase. The result of the teachers' interviews showed a problem that a module about food additives was required to enrich the vocational tourism students' knowledge in chemistry. The module was need to be construct in contextual approach in order to present the illustration among the food processing concept in the daily life problems with the chemistry concept. The contextual approach expected to make a meaningful chemistry learning on vocational tourism students [3]. Thus, the enhancing of students' chemical literacy will occur.

Consequently, on the development phase, FAM was constructed based on the basic competence of food processing and extended on chemistry content with contextual approach. The FAM was constructed in four theme covers sweeteners, preservatives, coloring and flavoring foods. The face and content validity of FAM were conducted by asking some reviewed from a group of experts. Necessary revisions were made according to the feedback of the experts. The experts declared that the FAM was feasible and worthy enough as the chemistry enrichment media for vocational students of tourism field.

Moreover, the quantitative step was conducted to obtain the FAM feasibility through the response of 7 chemistry teachers on four aspects includes the worthiness of chemistry concept, concept presentation, linguistics, and graphic. The result of the teachers' response on the FAM feasibility presents on the table 2.

According to Table 2, it sought that the chemistry concept of the FAM had a good category. The lowest score gained according to the indicator number 1 which showed that the content of the FAM was sufficient to develop the students' chemical literacy. Even thought, the FAM was constructed according to chemistry content based on the contextual approach of the vocational tourism field which may promote students' chemical literacy. This is in line with the study conducted by [9-10] which showed that contextual approach could improve students' chemical literacy due to the real life experience which provide. Hence, a module with contextual approach on chemistry learning could enhance students' chemical literacy.

Table 2. The result of FAM feasibility

Aspect	No	Score	Category	Ideal (%)	Aspect	No	Score	Category	Ideal (%)
Chemistry concept	1	3.00			Linguistics	14	4,43		
	2	3,71				15	4,29		
	3	4,29				16	4,43		
	4	4,43				17	4,43		
	5	4,14				18	4,29		
	6	3,71							
	Mean	3.88	Good	77.60			Mean	4.37	Very good
Concept presentation	7	3,14			Graphic	19	4,43		
	8	3,71				20	3,71		
	9	4,00				21	4,29		
	10	4,43				22	4,43		
	11	4,14				23	4,43		
	12	3,43				24	4,29		
	13	4,00				25	4,86		
	Mean	3.84	Good	76.80		Mean	4.35	Very good	87.00

The same result obtained on the concept presentation aspect, the FAM gained a good category. The lowest score found on the indicator number of 7 which showed that the FAM was sufficient in presenting the chemistry content with the context at the beginning of the chapter. At the beginning of the chapter provide some issues in the daily life relating the context of vocational tourism field, such as the used of food preservatives on the tofu. The beginning of the chapter on the FAM described on why some tofu has flies and some other tofu weren't. Hence, the content on the module which begin with the context of vocational tourism students bring a good quality of chemistry learning [11-14]. However, according to the result of this study, the context presents in the beginning of the chapter need to be improved.

On the other hand, according to the linguistic aspect, the FAM reached a very good category. All of the indicators on the FAM were centered in the very good category. The FAM being developed had a communicative, interactive, and straightforward language. The term being used were easy to understand, unambiguous, and used a consistent chemistry sign and symbol. These facts lead a very good category on the linguistic aspect.

Similarly, the graphic category signified a very good category. The indicators of the graphic aspect were centered on the very good category which indicated that the FAM was attractive to read. The vocational tourism students had less interest to learn chemistry due to the chemistry content which not related to the students' specific expertise [1]. Hence, the FAM is expected to enhance students' interest in learning chemistry. The result of these study confirmed the study conducted by [15-16] which showed that modifying the learning content leads the enhancing of students' interest. Overall, the FAM which being developed showed a good category. Thus, the FAM will be a useful tool for the teachers to enhance the quality chemistry learning of students in vocational tourism school. Figure 2 showed the summarized of the four aspects of teachers' response toward the FAM.

Based on figure 1, can be concluded that the linguistic and graphic aspects had a better result compared to the concept and content presentation aspects. However, the fourth aspects had equally good category according to the teachers' response. Thus, it can be used as a reference to enrich the chemistry knowledge of vocational tourism students.

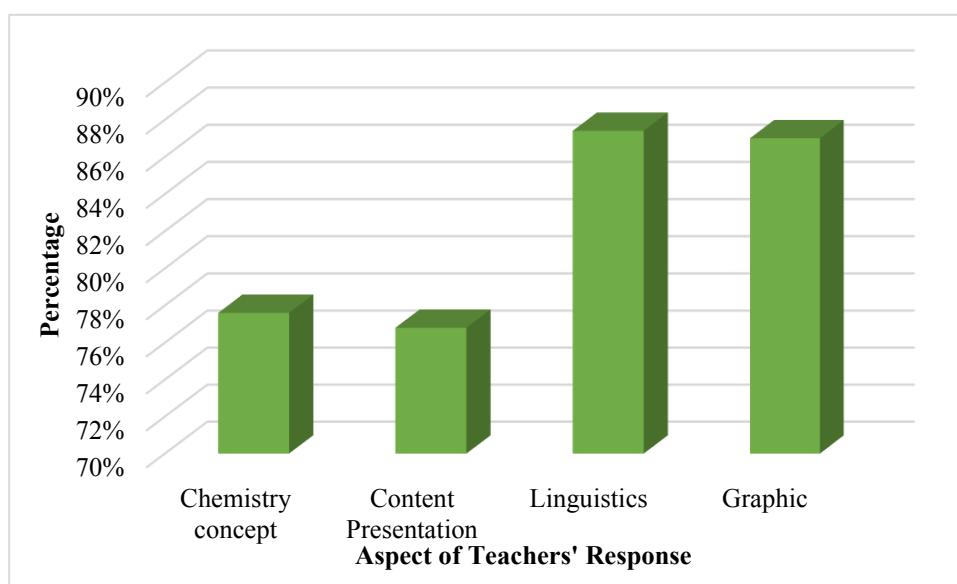


Figure 2. Ideal percentage of teachers' response toward FAM

4. Conclusion

The FAM which has been developed in this research has a good content and face validity declare by a group of expert. The correctness chemistry content, integration of contextual approach, and communicative language use in the FAM lead the experts consider that FAM is feasible to use. A good category is obtained as the result of the teachers' response toward the module. The contextual approach which use in the FAM expected to bring a meaningful chemistry learning on the vocational tourism students. Hence, this module could be used as reference for learning enrichment of tourism vocational school student to enhance chemical literacy.

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