

Development of learning media application to enhance skill of rice-cracker cost reduction in manufacturing

Fisik Sean Buakanok^{1*}, Paramin Wongkhamsing², Suwannee Kruaphung³, Phanuwat Rangsan⁴, Siwadol Waraeksiri⁵

^{1,2,3,4,5} Faculty of Education, Lampang Rajabhat University, Thailand

*Corresponding Author: Email: sean_f@g.lpru.ac.th

ABSTRACT

Learning media development is the study and ethical practice of facilitating learning and improving performance by creating. This study aimed to develop a learning media application for manufacturers to improve their skill of reducing costs in rice-cracker production so preventing problems of loss and poverty. This study's research and development methodology used the ADDIE model consisting of 5 stages: 1) analysis, 2) design, 3) development, 4) implementation; and 5) evaluation. Validation of learning media was undertaken by three experts, followed by three trials. The experimental one-shot case design comprised 20 rice cracker manufacturer participants obtained voluntarily and examined their skill level after media application use. Evaluation by the media experts (82.67% and 81.33%) and the instructional design expert (86.67%) indicate that the learning media application was of excellent quality. Results from the individual trial (83.11%), small group trial (84.29%), and field trial (79.51%), showed that the learning media application was effective in improving skill of rice cracker production cost reduction. Results of the test by 20 participants- mean score-27.40/30; T-test value-19.517; and Sig.= 0.000 (2-tailed)- indicate that they had the skills to reduce their manufacturing costs. Therefore, this instructional media merits use as learning media for improving the skill of rice cracker production cost reduction.

Keywords

learning media application; Multimedia; ADDIE model

Introduction

One of the major problems that manufacturers face is the issue of high production costs. Manufacturers of rice crackers in Ban Ko Kha community, Lampang province, Thailand, despite their diligence, continue to suffer from loss and poverty as a result of their high production costs. Therefore, enhancing the manufacturers' skills of production cost reduction could serve to alleviate these problems.

In the learning process, media plays an important role. According to Singkum (2019), media is an intermediary that can be used to provide information or messages enabling enhanced communication between the sender and the recipient. Learning media may use traditional learning materials, such as handouts, if the learners are educated but may not be effective for those with limited or no educational backgrounds (Romiszowski, 1992). The manufacturers in the present study had various of education backgrounds, some of whom never went to school.

Today, we have digital media that can improve and advance traditional education. According to Parisi (2015), the use of virtual reality media is

effective in achieving learning objectives. Learning media technology can really make learning more exploratory and enjoyable (Friedland, Hurst & Knipping, 2007), whilst Suyitno (2016), reported that the use of learning media has a positive effect on student learning outcomes with an increase in student achievement after using interactive learning media. Sugiyono (2013) concluded that the use of e-learning media showed a significant increase in learning motivation between pretest and posttest and can be used as one way to optimize the learning process, especially in overcoming the limitations of space and time.

A primary application of interactive learning media is in an instructional situation where learners are given control so that material may be reviewed at their own space and in keeping with their individual interests, needs, and cognitive processes (Thorndike, 1982). Although media applications as learning tools cannot fully replace hands-on learning, audio-visual characteristics can enhance and strengthen the learning experience, by enabling learners, for example, to watch 3D video clips of demonstrations and tests (Molenda, 2004). New information tools, such as video

streaming and audio, can be used to engage learners, effectively demonstrate concepts, and reinforce media literacy technologies (Malik & Agarwal, 2012).

In this study, we presented a developed learning media application to promote the skill of rice cracker production cost reduction. The objective of this interactive learning media was to make the learning media efficient in terms of time and delivery, but also easy to understand and be absorbed by the rice cracker manufacturers. Therefore, the learning media application had to be extremely well designed and sophisticated enough to mimic the best teacher, by combining in its design the various elements of the cognitive processes and the best technological quality (Malithong, 2005). We sought to engage rice cracker manufacturers using digital media tools, such as photo-sharing, video-publishing and map-making programs, to give them opportunities to demonstrate their mastery of a concept and simultaneously reinforce their literacy skills by having them create their own content.

Methods

This research used a research and development (R & D) methodology, involving production and testing of a specific product (McMillan, 2000). This research aimed to provide a product in the form of a learning media application with 3D video. The research and development stage of the media application was based on the ADDIE model (Branch, 2010) comprising 5 phases: 1) the analysis phase; 2) the design phase; 3) the development stage; 4) the implementation stage; and 5) the evaluation stage (Figure 1).

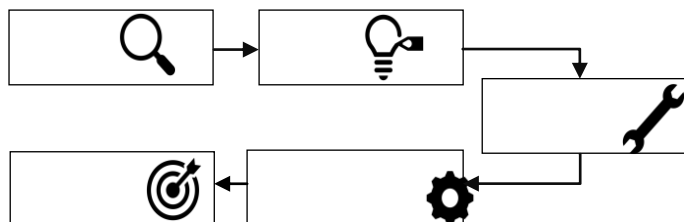


Figure 1. stages of ADDIE Model

The ADDIE model provided guidelines and a framework for production management of the video and interactive multimedia. Although this model is specifically a reference for developing

instructional designs, this model can equally be used for other interactive learning products such as learning media development. Descriptions of how each of the five phases were applied in the present study are outlined below:

I. Analysis: This stage identified all the variables that needed to be considered when designing the learning media application, such as manufacturers' characteristics, manufacturers' prior knowledge, resources available, cost problem analysis, target analysis, production analysis, and material analysis.

II. Design: The output obtained in the analysis phase was used as input in the design stage. This stage focused on identifying the learning objectives for the learning media application and how materials would be created and designed. It included describing what content areas were to be covered and a storyboard outlining what would be covered in text, audio and video, and in what order, as well as deciding on the selection of technology for production. In this study, it was decided to use a 3D video content design to teach about cost reduction in the manufacture of rice-crackers. Six ways to reduce production costs were identified according to the local wisdom of community members and corresponding to the situation in the community. These comprised reduction of labor costs, improvement of worker efficiency, reduction of the cost of materials, using fewer materials, consideration of lean manufacturing, and reduction of overhead costs. The design output was represented in a flowchart for easy development into the real learning media application program, as shown in figure 2.

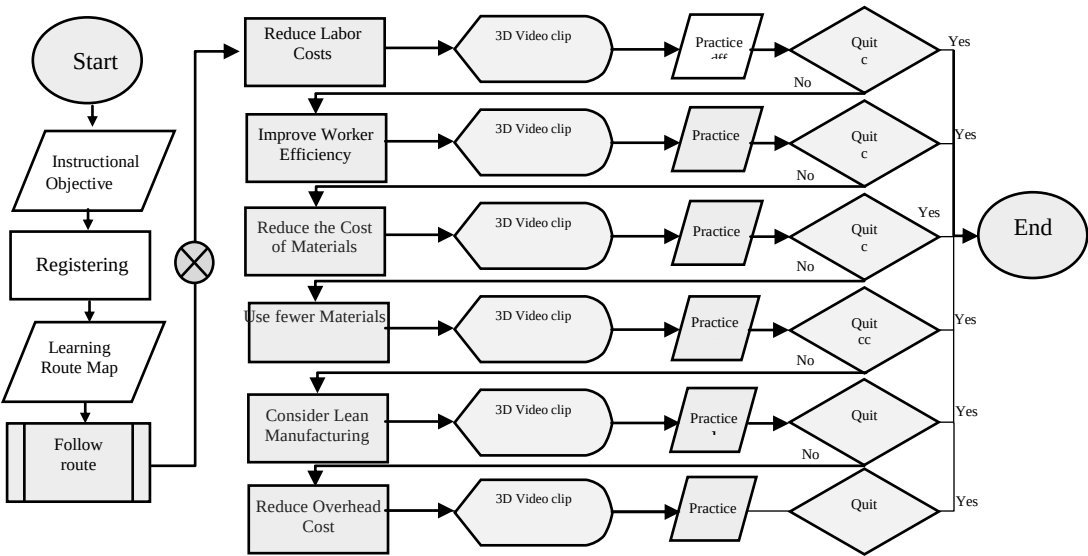


Figure 2. Flowchart of learning media application

III. Development: The development stage was to prepare documents for the production phase. Documents that need to prepared in this stage include the media content outline, material description, video script and storyboard (Costello, 2016). The special tool used in this study was a 3D video that works with 3D glasses. This was prepared using the video editing software Magix Xara 3D maker (figure 3). This program is suitable for anyone who has never worked with an animation program before. The interface is straightforward to learn, and the program comes with tutorials to help along the way. It has three places to access program features – on the top menu bar, on the right menu bar, and from the options menu on the left, meaning there is no need to worry about correctly remembering where to find something. Changing the colors, depth of shadows, and other options is done easily by simply clicking and dragging

The technique used to optimize 3D video production of this study was cutting from one angle to another, a simple and effective way to add visual interest to the video. This is a useful technique that shows video doing something rather than just talking. Changes in perspectives were shifted by at least 45 degrees, since smaller shifts in perspective would not create the intended effect, looking jarring to the viewer.

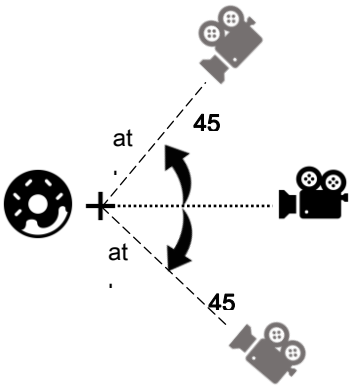


Figure 4. change perspectives by at least 45 degrees

IV. Implementation: This stage involved actual delivery of the learning media, including any prior training or briefing of the learner support staff, and assessment.

V. Evaluation: In this stage, feedback and data were collected in order to identify areas that require improvement and feeding into the design, development and implementation of the next iteration of the media (Stringer, 2007). This final



Figure 3. Magix Xara 3D maker software

stage compared the product with the target, incorporating revision and validation to improve product effectiveness.

The learning media application content intended to reflect the changes necessary for cost reduction in the manufacturing of rice crackers, as well as changes in the skills of the learners. The goal was to determine the effectiveness of the learning medium in terms of changes in the learners' skill of rice-cracker manufacturing cost reduction. Content was also linked to important 21st century skills, presented in five frameworks, which, it was considered, the manufacturers should have:

1) Flexibility and adaptability: Manufacturers should have the flexibility to come up with ways to reduce costs.

2) Global and cultural awareness: In order to reduce production costs, the world and culture should be taken into account.

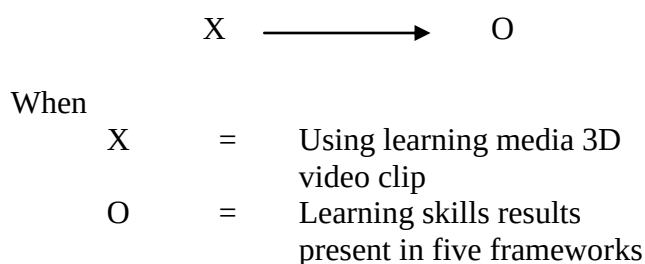
3) Information literacy: The skills in searching for information to prevent the loss of wrong information should be acquired.

4) Technology literacy: Manufacturers should have the skills to use technology to support production and reduce labor costs.

5) Initiative: Manufacturers should be able to solve production problems in a new way.

Methodology

The experimental plan One-shot case design with 20 samples who rice-cracker manufacturers obtained voluntarily. (Best, & Kahn, 1993)



Evaluating achievement used the following criteria: For successful use of the learning media application, the average score of manufacturers in the skill test must not be less than 24 points out of 30 (80%).

Sampling: A total of 20 samples who rice-cracker manufacturers obtained voluntarily to examine the skill after use application.

Data Analysis

A study of the feasibility of the developed learning materials used in this research was carried out. Structured questionnaires to collect data using an estimation scale were used. Evaluation was performed using scoring criteria that employed the terms 'strongly agree', 'agree', 'neither agree nor disagree', 'disagree', and 'strongly disagree'. There were three feasibility tests: 1) one-on-one trials; 2) small group trials; and 3) field trials. Descriptive analysis of the data was carried out. Scoring for the feasibility of the product used in this study was based on that used by Preedy & Watson (2010). The effectiveness of the design can be examined to determine the level of performance and satisfaction level of the media results (Najjar, 1996).

Results

Qualitative assessment step

Quantitative data obtained from assessment results can be converted into qualitative data using the average score of answers on each item assessed (Koul, 1984). The criteria for evaluating media feasibility based on the interpretation of scores are shown in table 1.

Table 1. Media Quality Classification

Scoring scale	category	Percentage
1	Strongly disagree	0 - 20 %
2	Disagree	21 - 40 %
3	Neither agree nor disagree	41 - 60 %
4	Agree	61 - 80 %
5	Strongly agree	81 - 100 %

One-on-one trials

The results from the learning application media trials carried out by two experts are described in Table 2.

Table 2. The Results of Experts

No	Assessment Aspect	Assessment Indicator	Media Expert Score 1	Media Expert Score 2
1	Effectiveness of screen design	Font size	4	4
		Shape / typeface	5	4
		Font color	4	4
		Image quality	3	3
		Color composition of background color	4	4
		Clarity of narration	5	4
		Image effectiveness	4	5
2	Audio or sound	Music companion	4	4
		Narrator's voice	5	4
3	Smooth operation of program	Program easy to operate/use	4	5
		Systematic presentation	4	4
4	Consistency	Consistency of words/ sentence terms	4	5
		Consistency of rippling / grooving	3	4
5	Navigation	Effectiveness of navigation	5	4
		Navigation functions	4	3
Total Value			62	61
Average value			4.13	4.06

The following formula (Riduwan, 2013) was used in the assessment of the learning media:

$$P = \frac{\text{Total score} \times 100}{\text{Number of items} \times 5}$$

P = Percentage
 Total Score = Total sum of questionnaire scores
 Number of Items = Total number of items in the questionnaire
 100 = Percentage (%)
 5 = The highest value for each item

According to the above formula, the assessment scores of the two media experts are as follows:

Media Expert 1:

$$P = \frac{62}{15} \times \frac{100}{5} \quad P = 82.67 \%$$

Product Quality = Excellent

Media Expert 2:

$$P = \frac{61}{15} \times \frac{100}{5} \quad P = 81.33 \%$$

Product Quality = Excellent

The results of the trials carried out by the two media experts indicated that the learning media application for rice cracker production cost reduction was of excellent quality (>80%). The percentage value of the first media expert was 82.67% and the second media expert was 81.33%. The results of media trials carried out by an instructional design expert are described in Table 3. below.

Table 3. Results of learning application media feasibility trial by instructional design expert.

No	Assessment Indicator	Score
1	The instructions for using the program are clear	5
2	The displayed image is of high quality	4
3	The color composition matches the background	4
4	The sound can be heard clearly	4
5	The music is appropriate	4
6	The text can be read clearly	5
7	The learning objectives are clear	4
8	The sentences in the text are easy to understand	4
9	The material content is easy to understand	4
10	The examples given are clear	5
11	Learning interaction on the video is good	5
12	The order of presentation is appropriate	4
Overall Value		52
Average Value		4.33

According to the formula above, the assessment score of the instructional design expert is as follows:

Instructional design expert:

$$P = \frac{52}{12} \times \frac{100}{5} \quad P = 86.67\%$$

Product Quality = Excellent

The percentage result of the trial (86.67%) carried out by the instructional design expert indicated that the learning media application for rice cracker production cost reduction was of excellent quality (>80%).

Small group trials

The first small group trial comprised a group of three randomly selected students with differing characteristics in terms of gender, age, and knowledge. The results from the students' evaluation of the learning media application feasibility are shown in Table 4.

Table 4. Results of learning application media feasibility trial by small group 1

No	Assessment Indicator	Score	Average Score
1	The opening is interesting and attractive	15	5.00
2	The instructions for using the program are clear	10	3.33
3	The displayed image is of high quality	14	4.67
4	The color composition matches the background	12	4.00
5	The sound can be heard clearly	13	4.33
6	The music is appropriate	9	3.00
7	The text can be read clearly	14	4.67
8	The learning objectives are clear	11	3.67
9	The sentences in the text are easy to understand	13	4.33
10	The material is easy to understand	14	4.67
11	The examples given are clear	15	5.00
12	Learning interaction within the application is good	8	2.67
13	Transition through the video is smooth and clear	12	4.00
14	The order of presentation is appropriate	13	4.33
15	The order of presentation is creative	14	4.67
Overall Value		187	62.33
Overall average value			4.15

According to the formula above, the assessment score of the small group trial 1 carried out by three students is as follows:

Small group trial (1):

$$P = \frac{187}{15 \times 3} \times \frac{100}{5} \quad P = 83.11 \%$$

Product Quality = Excellent

The percentage result of the trial (83.11%) carried out by a small group of three students indicated that the learning media application for rice cracker production cost reduction was of excellent quality (>80%).

The second small group trial comprised a group of nine randomly selected students with differing characteristics in terms of gender, age, and knowledge. The results from the students' evaluation of the learning media application feasibility are shown in Table 5.

Table 5. Results of learning application media feasibility trial by small group 2

No	Assessment Indicator	Score	Average Score
1	The opening is interesting and attractive	40	4.44
2	The instructions for using the program are clear	40	4.44
3	The displayed image is of high quality	36	4.00
4	The color composition matches the background	38	4.22
5	The sound can be heard clearly	39	4.33
6	The music is appropriate	41	4.56
7	The text can be read clearly	36	4.00
8	The learning objectives are clear	39	4.33
9	The sentences in the text are easy to understand	37	4.11
10	The material is easy to understand	38	4.22
11	The examples given are clear	35	3.89
12	Learning interaction within the application is good	41	4.56
13	Explanation of cost reduction in rice cracker manufacturing is clear	33	3.67
14	Explanation of reasons for high costs in rice cracker manufacturing is clear	34	3.78

15	Explanation of how to implement measures for cost reduction in rice cracker manufacturing is clear	42	4.67
Overall Value		569	63.22
Overall average value			4.21

According to the formula above, the assessment score of the small group trial 2 carried out by nine students is as follows:

Small group trial (2):

$$P = \frac{569}{15 \times 9} \times \frac{100}{5} \quad P = 84.29 \%$$

Product Quality = Excellent

The percentage result of the trial (84.29%) carried out by a small group of nine students indicated that the learning media application for rice cracker production cost reduction was of excellent quality (>80%).

Field Trial

The field trial was carried out by a group of thirty students with differing characteristics in terms of gender, age, and knowledge. The results from the students' evaluation of the learning media application feasibility are shown in Table 6.

Table 6. Results of learning application media feasibility trial by field group

No	Assessment Indicator	Score	Average Score
1	The opening is interesting and attractive	133	4.43
2	The instructions for using the program are clear	125	4.17
3	The displayed image is of high quality	130	4.33
4	Color composition matches the background	142	4.73
5	The sound can be heard clearly	110	3.67
6	The music is appropriate	128	4.27
7	The text can be read clearly	132	4.40
8	The learning objectives are clear	117	3.90
9	The sentences in the text are easy to understand	98	3.27
10	The material is easy to understand	103	3.43
11	The examples given are clear	109	3.63
12	Learning interaction within the application is good	111	3.70
13	Explanation of cost reduction in rice cracker manufacturing is clear	95	3.17
14	Explanation of reasons for high costs in rice cracker manufacturing is clear	122	4.07
15	Explanation of how to implement measures for cost reduction in rice cracker manufacturing is clear	134	4.47
Overall Value		1789	59.63
Overall average value			3.97

According to the formula above, the assessment score of the field group trial carried out by thirty students is as follows:

Field group trial:

$$P = \frac{1789}{15 \times 30} \times \frac{100}{5} \quad P = 79.51 \%$$

Product Quality = Good

The percentage result of the field group trial (79.51%) carried out by thirty students indicated

that the learning media application for rice cracker production cost reduction was of good quality (71-80%).

The conclusion that can be drawn from the above data is that the media application for learning about cost reduction in the manufacturing of rice crackers is of excellent quality and therefore highly suitable for use.

Media experiment step

The media experiment step used 20 participants (10 males, 10 females) to observe the results of 5 skills: 1) flexibility and adaptability, 2) global and

cultural awareness, 3) information literacy, 4) technology literacy, and 5) initiative.

The average score of the participants when taking the skill test was required to be not less than 80% (24 points out of 30).

One Sample T-test

$H_0: \mu = 24$ (The average of skill points is equal to 24)

$H_1: \mu \geq 24$ (The average of skill points is more than 24)

The results are shown in table 7.

Table 7. Five skills achievement of rice-cracker cost reduction in manufacturing.

	Test Value = 0					
	t	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Score	19.517	19	.000	27.40	24	30

Table 7 shows that the mean score was 27.40, the T-test value was 19.517 and Sig.=0.000 (2-tailed). In relation to hypothesis testing, if Sig. < 0.000 shows, H_0 is rejected and H_1 is accepted.

Discussions

The changing nature of education is currently being reinforced with the integration of learning media technology leading to a new paradigm in educational methodology and the evolution of new concepts in content development and a number of innovative methods in which information can be communicated to the learner. Given the usefulness of learning media to many different career scenarios, surely in time learning media technology will be available to one and all. However, its usage should be limited to and in consideration of its pedagogical strengths, learning media from other fields, and varying procedural methods. The learning media community may be the perfect platform for bringing researchers and educators together in order to help improve learning media-based education, developing learning in different fields, not only at school. Based on the results of the study, the researcher can conclude that the different method of teaching proposed in this study, is beneficial. This method used a learning media application comprising a 3D video and interactive practice stages that sought to improve the skills of the learners and suit their different learning experiences. In addition, the ADDIE model is a flexible way to build effective media, allowing for evaluation to determine the performance and satisfaction levels of the media

(Richey, 2008). The practical, interactive media application used in this study, was designed in accordance with the ADDIE model providing a new way of teaching communication resulting in more effective learning and better performances outcomes of the learners. The impact on the manufacturers' learning was remarkable and the success may be attributed to the inherent interaction ability, feedback program, and integration of such an interactive learning media program (Mcgloughlin, 2001). The effectiveness of the Magix Xara 3D maker program, based on the ADDIE model, in making the learning media more effective and boosting the manufacturers' performance, is evident. The rice cracker manufacturers were very excited about the interactive learning media and felt that it closely met their needs. The design meant that they did not feel left behind, giving them the chance to fully understand the content by being able to reviewing the material as many times as they wanted.

Conclusion

According to the results of this research, the effectiveness of the developed learning media application to promote the manufacturers' skill of cost reduction in the production of rice crackers, can be seen. Development of the learning media used the ADDIE model comprising 5 stages of analysis, design, development, implementation, and evaluation. Validation and assessment, carried out by media and instructional design experts showed the application to be of excellent quality. Results from individual, small group and field trials further indicated the efficacy of the learning

media and its suitability for use by rice cracker manufacturers to develop production cost reduction skill. It is hoped that the further development of this kind of learning media may

be applied to a broad range of study settings to enhance and strengthen the learning experience.

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