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The innovation of deltoid muscle injection models

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Abstract

The major concern of the public health program is that the currently used muscle models for deltoid muscle injection are costly and inadequate for students to practice basic nursing skills. Thus, this research and development (R&D) study aimed at developing an innovation of the deltoid muscle injection model and examining the students' satisfaction toward the developed model. The volunteer samples comprised 60 students in their third and fourth year with practical experience in intramuscular injection. The statistics used in the data analysis were frequency, percentage, mean and standard deviation. The finding indicated that the developed low-cost deltoid muscle injection models were composed of inexpensive and lighter materials, together with different sizes created. The developed models also had the advantage that the fluid, usually water, could be used while training for injections. The samples rated their satisfaction toward the developed models at a high level ($\overline{X}$ = 4.11). The developed deltoid muscle injection models were likely to support self-learning, to improve students' nursing skills and confidence when performing injections.

Keywords: Innovation; Deltoid muscle; Intramuscular injection

1. Introduction

The National Education Act of B.E. 2542, amended in B.E. 2545 and B.E. 2553 on the educational guidelines, identifies educational management with regard to the emphasis on learner-centered approach based on the following principles: learners' development and self-learning. In addition, the education management process shall encourage learners to develop their full potential and natural skills, promote and support teachers to be able to provide an effective learning environment, facilitate learners' learning and knowledge, and employ research as a part of learning process. Moreover, teachers and students shall be able to learn together through different teaching strategies, media and a wide range of disciplines. The various activities provided shall encourage learners to learn through simulated experiences in order to build expertise [1]. The provision of accurate information to students is required in order to

help students create individual knowledge. Therefore, provision of both field practice and theoretical practice would be necessary to encourage students to learn continuously and extensively at all times.

The Health Science Program of Faculty of Science and Technology at Sakon Nakhon Rajabhat University plays an important role in health promotion, disease prevention, primary care, and rehabilitation. Its curriculum focuses on the integration of learning contents with both theoretical learning and practical situations; therefore, the students are able to develop professional skills and will be well-prepared to enter workforce. Thus, field experience is the major key for public health teaching and learning process focusing on the learners' skill development. Evidence from an assessment of nursing mentors and related research results in the public health field experience over the past few years revealed that in terms of operative practice with regards to intramuscular injection and vaccinations for children, students reported a lack of confidence in injection practices and limited nursing skills [2].

This data was further analyzed and revealed the following factors that caused above issues: 1) In terms of teaching and learning, the first aid courses were taught in the second semester of the second year. During this period students were focusing on theory and practice tasks related to different topics such as injection practice with the model. The examination was scheduled outside school hours. 2) The number of the models available was inadequate for training practice. In this case, the program provided only two models and one arm muscle injection model per 70-80 students. The students were also unable to borrow the model to do self-practice outside the laboratory because of its heavy weight elements. 3) The students did not have opportunities to explore real-life scenarios.

From the issues stated above, the researcher is interested in creating an innovation of arm muscle injection. The purposes of this study are to 1) create and develop an innovation of deltoid muscle injection models, and 2) examine the students' satisfaction in public health program toward the developed deltoid muscle injection models. Therefore the proposed innovation could contribute to teaching effectiveness and learning process for students in public health to improve their nursing skills in terms of injection function. In addition, the developed injection arm models could be improved effectively and accepted by the institutes of medicine and other health centers.

2. Materials and methods

This research and development project is divided into two phases:

Phase I was related to creating and developing deltoid muscle injection models

1) The researcher explored the needs of 20 students in the health sciences who finished the first aid course and two instructors in the field of health science program. The results revealed that they required simulated models which could be worn on the upper arm with the following features: flexible materials, resistance to syringe, lightweight, portable and affordable. After the survey, the researcher studied related documents and research papers in terms of the creation and development of a muscular injection model and other related topics. The materials used for and designed on the featured set were also based on the needs of students and instructors, the expert advisors in nursing hospitals, the nursing course instructors in anatomy and physiology, and instructors in the field of health science program. After that, the models of arm muscle injection were created by the researcher, as shown

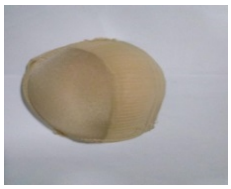
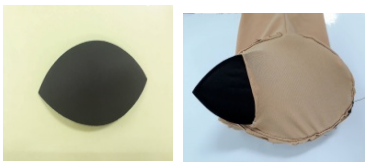
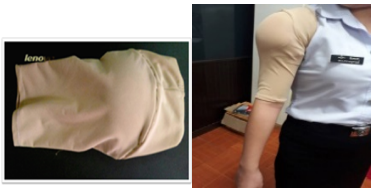
in Table 1. The models were assessed by nursing instructors in the public health programs. The problems were found, such as the shape of the developed model was similar to the deltoid muscles in triangle, but not virtual reality. In addition, the size was too big and not wearable.

Table 1 The creation and development of innovative deltoid muscle injection model at the first time

Materials	Qualification	Procedures
	- A triangular shape. - The silicone color is lifelike skin and elasticity.	1. Outside appearance - The silicone sheet covering with stockings. - The shape was tailored like the deltoid muscle in triangle. - The outside material covering with fabric sewn with straps 2. Inside appearance - The sponge was supported by a piece of hard plastic for needle penetration. - Sewn with zipper preventing the slip of sponge.

Phase II was related to assessing the developed deltoid muscle injection model as shown in Table 2. The developed models were reviewed by four experts, two nursing instructors from the field of health science program at Sakon Nakhon Rajabhat University and two nursing specialists at Sakon Nakhon hospital. In accordance with the assessment results, the developed models had a density and realistic viscosity, realistic feel and remained intact after injections. The experts' recommendation was on a further development of the model with different sizes in order to suit human's physical appearance.

Table 2 The developed deltoid muscle injection model in Phase II study

Materials	Qualification	Procedures
1. Underwear - made deltoid muscle  - add thickness 	- Shaped like a triangular manner. A sponge texture is like deltoid muscle, as shown in Fig. 1 [3]. The supplement used as being a shoulder connected to the acromion process.  **Fig.1** Deltoid muscle	1. Use a sponge bra with a thickness of 1 – 1 ½ inches, and then cut into 2 pieces. Trimmed the shape into a triangular of muscle deltoid shapes. 2. Covered with one layer of fabrics. Its back was stretched and split of about 2 cms in order to put additional foam to support the thickness of the muscle, and the plastic sheets to prevent needle penetration.
2. Spandex 	- Spandex fabric is employed as its quality of polyester fiber fabric making a fabric great flexibility, tightness and wearable.	3. Choose a fabric spandex with lifelike skin and cut into a shape like upper arm.
3. Transparent plastic sheet  	- Transparent plastic sheet was tested with injection needles till they cannot pierce it. The models are used like humorous bone and the hypodermic and to prevent the needle dinamem case during wearing for the upper arm practice.	4. Remove the plastic and cut in a circle or ellipse shape in order to be inserted into the created model.
4. Deitoid muscle model 	- The developed model is like the arms which is worn close to the arms and upper arms. The area added sponges shape is like the upper arm muscle (deltoid muscle), as shown in Fig. 1.	5. Cut the developed arm muscle (deltoid muscle) like as shown in item 1 and 2 and sew the fabric on the elastic sleeves.

Phase II was related to the satisfaction toward the developed deltoid muscle injection model.

1) The samples consisted of 60 students in health science program with the following characteristics:

1.1) 30 students in their third year and 30 students in their fourth year in health science program who had passed the first aid course.

1.2) The samples had experiences in intramuscular injection for patients.

1.3) The samples volunteered to participate in this research.

2) Research Tool. The instrument used for data collection was a set of questionnaires consisting of two parts:

Part 1 : Personal information involving gender, age, year level and experience in intramuscular injection.

Part 2 : The ten items covering quality aspects: usability, realistic style and feel, confidence for future practice, storage requirements, durability, usability, cost, and resistance to syringe. It is a five-point Likert-type scale, with a label for each category: completely satisfied (5 points), very satisfied (4 points), moderately satisfied (3 points), slightly satisfied (2 points) and dissatisfied (1 point). The level of satisfaction is based on the criteria set of Best [4] which is divided into three levels:

$$\frac{\text{Max - Min}}{\text{Interval}} = \frac{\text{highest score - lowest scores}}{\text{satisfaction levels}} \quad (1)$$

$$= \frac{5 - 1}{3}$$

$$= 1.33$$

Average scores 3.67 – 5.00 means high

Average scores 2.34 – 3.66 means moderate

Average scores 1.00 – 2.33 means low

3) Data analysis. The statistics used for data analysis were frequency, percentage, average and standard deviation.

3. Results and Discussion

1) The innovated deltoid muscle injection model was developed to resemble an upper arm deltoid shape muscle which can be worn on the arm. The additional sponge is added to increase thickness; a sheet of plastic added for preventing needle dinamem. The outstanding point of the developed models was a decreased cost of 200 baht, compared to a commercial arm muscle model at a price of 50,000 baht. The developed models could also be adjusted in size. The stretch band model simulates the arm muscles realistically for virtual muscle injection training, being fairly resistant, lightweight, portable, and storage. Also it allows the students to borrow them to practice on their own. The results based on the evaluation of innovated injection deltoid muscle models are shown in Table 3 and 4.

Table 3 Demographics of the samples (n=60)

General Information	Total	Percentage
1. Gender		
- Male	8	13.30
- Female	52	86.70
2. Age (year)		
- 20 years	3	5.00
- 21 years	34	56.70
- 22 years	17	28.30
- 23 year	6	10.00
$\overline{X}$ = 21.60 years		
3. The experience in intramuscular injection		
- 1 – 10 times	42	70.00
- 11 – 20 times	11	18.30
- 21 – 30 times	5	8.30
- 31 time's up	2	3.40
Min=2 Max= 50 $\overline{X}$ = 11.40		

Table 4 Mean scores of participating students' satisfaction level (n=60)

Evaluation topics	$\overline{X}$	S.D.	Satisfaction level
1. Density and realistic viscosity	3.88	0.56	high
2. Resistance to syringe	3.77	0.67	high
3. Reality feel	4.05	0.67	high
4. Portability	4.42	0.59	high
5. Easy storage	4.27	0.63	high
6. Durability	3.93	0.68	high
7. Low cost	4.40	0.66	high
8. Realistic appearance	4.12	0.58	high
9. Confidence for future practice	4.18	0.62	high
Evaluation total	4.11	0.62	high

2) The satisfaction of the health science students toward the developed deltoid muscle injection models were at a high level which was consistent with the study of B. Duangrat et al. [5] and P. Chotiban et al. [6] that the model should be both easy storage and portability. The students are able to learn independently outside the classroom.

Considering the materials specifications of a muscle arm model, the commercial muscular arm models are made from rubber, which may seem more realistically simulate flesh and skin, and are adjustable with a belt to fit the patients' arms. The additional sponge can also add inside a simulated upper arm muscle for real-life muscle purpose. The model can be used many times. However, the developed arm muscle injection models were made of spandex fabrics and sponge bras resulting in cost saving and improved fit while exhibiting equally realistic shape and feel when training. Therefore the students were able to practise the nursing skills effectively and consciously during injection training. As a result of this, the students gained more confidence for future practice.

However, the limitation of the developed model was that it shows no markings for intramuscular injections.

Also, further development to enhance effective arm injection by implementing needle plate sensoring with electronic sounds should be considered. Unusual sights or sounds of the stimuli (deltoid muscle injection model) are likely to arouse learners' interest and help them better focus and performance, according to the Law of Effect of Thorndike [7].

4. Conclusion

The developed deltoid muscle injection model can help students practise intramuscular injections into the upper arm muscle and gain confidence in training and future performance. The developed models are likely to support self-learning and basic nursing skills.

5. Suggestions

1. The institution should encourage teachers to implement the innovation into practice due to its effective use and benefits.

2. The publication of the innovative model and arm muscle injection model is required to enable use in other nursing institutions and health services centers.

6. Acknowledgement

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