

การศึกษาประเด็นการใช้เครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูงของ
คณะกายภาพบำบัด มหาวิทยาลัยมหิดล

Study of Issues Regarding Usage of High-Tech Research Instruments in
the Faculty of Physical Therapy, Mahidol University

นัฐพร อินทวิชารัตน์, ศรีแพร หนูแก้ว, จารุกูล ตรีไตรลักษณ์

Nattaporn Intawachirarat, Sripair Nookaew, Jarugool Tretriluxana

บทคัดย่อ

เครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูงได้เข้ามามีบทบาทสำคัญสำหรับการพัฒนาองค์ความรู้ และความสามารถในหลากหลายสาขา ณ ปัจจุบันเทคโนโลยีในสาขาชีวการแพทย์ยังมีราคาแพง และต้องการผู้ใช้งานที่มีความสามารถในเชิงลึกและมีทักษะเฉพาะทาง ในคณะกายภาพบำบัด มหาวิทยาลัยมหิดล นั้นมีเครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูงหลายอย่างที่โดดเด่น อย่างไรก็ตามนักวิจัยบางในคณะบางส่วนไม่ชอบที่จะใช้เครื่องมืองานวิจัยเหล่านี้ เพื่อการปรับปรุงและพัฒนาจึงควรศึกษาวิธีการใช้งาน ปัญหาที่อาจเกิดขึ้นและความคาดหวังของเครื่องมือวิจัยจากนักวิจัยในสาขากายภาพบำบัด

การศึกษานี้ได้ทำการสำรวจปัญหาเกี่ยวกับการใช้เครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูง ในคณะกายภาพบำบัด มหาวิทยาลัยมหิดล โดยใช้แบบสอบถาม กลุ่มตัวอย่างได้แก่ นักเรียน อาจารย์ และนักบำบัด ที่ใช้เครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูง หัวข้อในแบบสอบถามประกอบด้วยพื้นหลังของผู้วิจัยต่อใช้งานของอุปกรณ์นั้นๆ ปัญหาที่อาจเกิดความคาดหวังสำหรับแนวทางการพัฒนาข้อมูลโดยเฉลี่ย แล้วตีความออกเป็นสามระดับของมาตราส่วนโดยใช้สามเกณฑ์สำหรับการตีความ: เห็นชอบ ไม่แน่ใจ และความไม่เห็นชอบ ในที่สุดผลการสรุปผลสถิติเชิงพรรณนาโดยใช้ร้อยละ ค่าเฉลี่ย และส่วนเบี่ยงเบนมาตรฐาน

จากผลของการศึกษาทำให้ได้วิธีการที่เหมาะสม สำหรับการจัดการและใช้งานเครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูงของคณะกายภาพบำบัด มหาวิทยาลัยมหิดล ดังนั้นจึงสามารถเลือกใช้วิธีการและคุณสมบัติของเครื่องมือวิจัยที่มีเทคโนโลยีขั้นสูงสำหรับการวิจัยได้อย่างใช้อย่างเหมาะสมตามประสบการณ์ของนักวิจัย นอกจากนี้ทำให้รู้ถึงปัจจัยในด้านมนุษย์ของนักวิจัยในสาขากายภาพบำบัด เพื่อใช้ในการพัฒนาเครื่องมือวิจัยต่อไป

ABSTRACT

High-tech research instruments have a vital role to develop the knowledge and capability in several fields. Currently, high-tech research technologies in the biomedical fields are expensive and require in-depth specific skill. In the Faculty of Physical Therapy, Mahidol University, we have several outstanding high-tech research instruments. However, the certain researchers in this faculty do not favor to use these research instruments. To improve these, we should study the usability, potential issues, and expectation of research instruments from researchers in the physical therapy fields. There are significant of realizing and managing approach to provide superior operation, interaction, and inspiration.

This study has surveyed the issues regarding usage of high-tech research instruments in the Faculty of Physical Therapy, Mahidol University by using the questionnaire. A sample group is the students, instructors, and therapists that used the high-tech research instruments. The topics in a questionnaire consist of the subject's background, the instrument usability, the potential issue, the expectation for development approach. The average data interpreted into three levels of the Likert scale by use three criteria for interpretation: agreement, uncertainty, and disagreement. Finally, the results conclude descriptive statistics by using percentage, average, and standard deviation.

From the results, they provide useful appropriate approach for managing high-tech research instruments in the Faculty of Physical Therapy, Mahidol University. Hence, the operation and the specification of high-tech research instruments decide to use appropriately regarding researcher's experience. Moreover, the human factors of researchers in the physical therapy fields regarding high-tech research instruments are obtained for developing the research instrument.

Key words: Biomedical instrument, Physical therapy

E-mail address: nattaporn.int@mahidol.ac.th

Introduction

Background

High technology of research instruments has a vital role to develop the knowledge and capability in several fields. Therefore, the end user should have the essential skills for operating and troubleshooting those high-tech instruments. Currently, high-tech technologies in the biomedical fields

are expensive and require specific skills. Hence, the operation and specification of high-tech instruments should decide for using appropriately regarding user's experience.

In the Faculty of Physical Therapy, Mahidol University, they have several outstanding high-tech research instruments and have strategic plan to be excellent by research. However, certain users in this faculty do not favor to use regarding these research instruments. To improve these, the authors have planned to study the usability, the potential issues, and the expectation of research instruments from users in the physical therapy fields. There are significant of realizing and managing approach to provide superior operation, interaction, and inspiration for users in the Faculty of Physical Therapy, Mahidol University.

Objectives

- To study the potential issues of research instruments from users in the Faculty of Physical Therapy, Mahidol University
- To study the expectation for development approach of research instruments from users in the Faculty of Physical Therapy, Mahidol University
- To exhibit the appropriate managing approach of research instruments for administrators in the Faculty of Physical Therapy, Mahidol University

Scope

Use the questionnaire to study usage's behaviors of high-tech research instruments from students, instructors, and therapists in the Faculty of Physical Therapy, Mahidol University.

Expected Benefits

- Human factors of researchers regarding research instruments in the physical therapy fields.
- Appropriate approach for managing research instruments at the Faculty of Physical Therapy, Mahidol University.

Literature Review

The questionnaire is widely used in the survey as a research tool. Nowadays, it becomes capability that is the most popular because it directly derived information from the actual. Hence, the information is reliable and up to date to solve problems, set policy, and plan development. Two advantages of the questionnaire are a collection of query data allows the data is the same manner or style (uniformity), and the information is the same manner as the original (primary data) [1].

Questions of the survey research can classify into three structures: closed-ended, open-ended, and contingency questions [2]. From the conditions of easy to answers, specific questions, and no difference between articulate and inarticulate respondents, the closed-ended questions are the

best adoption. The color of the questionnaire has effected on response rate. The most effective color is purple regarding both of genders, all age groups, and each response wave [3].

The practice of evaluating interaction with technology is embedded in disciplines such as human-computer interaction, cognitive ergonomics, error analysis, skill rule, knowledge based behavior, and resolution can provide biases [4]. The impact from understanding technology on the end user is an importance human factors that should realize. The factors that should focus in design to be the criteria for implementation processes consist of organizational factors, technology factors, job factors, and individual factors [5].

Methodology

This study has surveyed the issues regarding usage of high-tech research instruments in the Faculty of Physical Therapy, Mahidol University by using the questionnaire. All methods will describe as follow steps.

Data Collection

A sample group is the students, instructors, and therapists of the Faculty of Physical Therapy that used the high-tech research instruments. There are target populations (N) about 70 people (October 2012). Therefore, it can calculate a sample size (n) by giving level of precision (e) equal 0.05 from the Yamane's formula [6]:

$$n = \frac{N}{1 + N(e)^2} = \frac{70}{1 + 70(0.05)^2} \approx 60 \text{ people}$$

Questionnaire has three main parts as shown in Figure 1. First part is checklists and yes-no questions of the subject's background and the instrument usability. Second part is rating scales of the potential issue and the expectation for development approach. They are designated into five scales consisting of: 5 is strongly agree, 4 is agree, 3 is uncertain, 2 is disagree, and 1 is strongly disagree. Last part is comments and suggestions on the instrument usability, the potential issue, the expectation for development approach, and others.

Content validity of this questionnaire was approved by three experts in several fields from Mahidol University consisting of: Assoc. Prof. Somboon Sirisunhirun, Ph.D. from the Faculty of Social Sciences and Humanities, Asst. Prof. Jarugool Tretriluxana, Ph.D. from the Faculty of Physical Therapy, and Asst. Prof. Jackrit Suthakorn, Ph.D. from the Faculty of Engineering.

Relative validity of this questionnaire has obtained by examining on two subjects of non-target group in two trials. The average precision is 83.33 percentages.

QUESTIONNAIRE FOR COLLECTING THE USER BEHAVIOR REGARDING RESEARCH INSTRUMENTS

Position: B.Sc. Student, Grad. Dip. Student, M.Sc. Student, Ph.D. Student, Instructor, Therapist

Research Track: Cardiopulmonary, Ergonomics, Exercise and Muscle Performance, Motion Analysis, Motor Control and Neural Plasticity, Postural Control and Balance, Others (please identify) _____

Research Instrument: AMTI Force Plate, Biodesx Dynamometer, BTE Workstation, EBNeuro EEG, F-Scan Pressure Sensor, miniBIRD Electromagnetic Measurement, Noraxon EMG, TMS System, VIASYS Metabolic Cart, Vicon Motion System, Zebris Force Distribution Platform, others (please identify) _____

Time Spent: less than 1.30 hr., 1.30-3.00 hr., 3.00-4.30 hr., 4.30-6.00 hr., more than 6.00 hr.

Source of Instrument Usability	Yes	No	Comments
You have learnt from class.			
You have read the advertised brochure.			
You have read the manual in dept.			
You have attended the training course.			
You usually read the research article or technical note.			
You usually ask the expended person.			
You usually search from the internet.			

Rating Score – 5 is Strongly Agree, 4 is Agree, 3 is Uncertain, 2 is Disagree, and 1 is Strongly Disagree

List of Potential Issues	5	4	3	2	1	Comments
There are sufficient instruments for users.						
User has basic knowledge and skill.						
It has taken short time for learning curve.						
Hardware performance is perfect.						
Software performance is perfect.						
It is easy to use.						
There is enough technical assistance.						

Rating Score – 5 is Strongly Agree, 4 is Agree, 3 is Uncertain, 2 is Disagree, and 1 is Strongly Disagree

Expectation for Development Approach	5	4	3	2	1	Comments
It is lightweight and has comfortable size.						
Instrument preparation is fast and easy to set up.						
Instrument instruction is practical and easy to use.						
Graphical User Interface (GUI) is intuitive and attractive.						
Result illustration is efficient and useful.						
It has more confidence on safety issue.						
It is compatibility with other instruments.						

Rating Score – 5 is Strongly Agree, 4 is Agree, 3 is Uncertain, 2 is Disagree, and 1 is Strongly Disagree

Comments and Suggestions

1) Source of instrument Usability

2) List of Potential issues

3) Expectation for Development Approach

4) Others

Figure 1: Questionnaire for collecting the user behavior regarding research instruments.

Data Analysis

The average data will interpret into three levels of the Likert scale. Subsequently, use these criteria for interpretation [6]:

$$\text{The width of the interval} = \frac{\text{Score}_{Max} - \text{Score}_{Min}}{\text{Scale}} = \frac{5 - 1}{3} = 1.333$$

If the average data is in the range of 3.668 – 5.000 points that interprets the agreement.

If the average data is in the range of 2.334 – 3.667 points that interprets the uncertainty.

If the average data is in the range of 1.000 – 2.333 points that interprets the disagreement.

Finally, the results will conclude descriptive statistics by using percentage (%), average (\bar{X}), and standard deviation (SD).

Results

First wave of collected results is from the subjects that doing the research in motion analysis track. The usually high-tech research instrument that they used is the Vicon motion capture system. This system consists of the AMTI force plates, the Bonita Optical cameras, and the Noraxon EMG

sensors. Sixty percentages of these subjects are the instructors and the rests are master degree's students. The average time spent from all subjects is about 3.30 hours per time.

The results in the section of source of instrument usability are shown:

- All subjects have learnt from class.
- Sixty percentages of subjects have read the advertised brochure, and the rests did not.
- Sixty percentages of subjects have read the manual in depth, and the rests did not.
- Sixty percentages of subjects have attended the training course, and the rests did not.
- All subjects usually read the research article or technical note.
- All subjects usually ask the expended person.
- All subjects usually search from the internet.

The results in the section of list of potential issues are shown:

- From a wording of "there are sufficient instruments for users", it got 4.8 points of average data that interprets the agreement.
- From a wording of "user has basic knowledge and skill", it got 4.2 points of average data that interprets the agreement.
- From a wording of "it has taken short time for learning curve", it got 2.8 points of average data that interprets the uncertainty.
- From a wording of "hardware performance is perfect", it got 4.0 points of average data that interprets the agreement.
- From a wording of "software performance is perfect", it got 3.4 points of average data that interprets the uncertainty.
- From a wording of "it is easy to use", it got 2.4 points of average data that interprets the uncertainty.
- From a wording of "there is enough technical assistance", it got 3.6 points of average data that interprets the uncertainty.

The results in the section of expectation for development approach are shown:

- From a wording of "it is lightweight and has comfortable size", it got 2.6 points of average data that interprets the uncertainty.
- From a wording of "instrument preparation is fast and easy to set up", it got 3.6 points of average data that interprets the uncertainty.
- From a wording of "instrument instruction is practical and easy to use", it got 3.6 points of average data that interprets the uncertainty.
- From a wording of "Graphical User Interface (GUI) is intuitive and attractive", it got 4.2 points of average data that interprets the agreement.

- From a wording of “result illustration is efficient and useful”, it got 4.8 points of average data that interprets the agreement.
- From a wording of “it has more confidence on safety issue”, it got 4.8 points of average data that interprets the agreement.
- From a wording of “it is compatibility with other instruments”, it got 4.8 points of average data that interprets the agreement.

Discussion and Conclusion

High technology of research instruments have required time for learning curve. Hence, they are not easy to use for the basic user. Instrument preparation, instrument instruction, and software performance have provided some issues for users. All users like the instrument that is lightweight and has comfortable size.

Almost subjects have studied for using the high-tech research instrument in several sources. However, they still have some complicated issues regarding those instruments. There are occurred because the behavior background of the normal therapist in Thailand. Perchance, if they have enough the suitable technical assistance to support and advice, these issues will decrease.

From the results, they provide useful appropriate approach for managing high-tech research instruments in the Faculty of Physical Therapy, Mahidol University. Hence, the operation and the specification of high-tech research instruments decide to use appropriately regarding researcher's experience. Moreover, the human factors of researchers in the physical therapy fields regarding high-tech research instruments are obtained for developing the research instrument.

References

- [1] P. Mansilp, "The research topics of social communities in the mangroves," D. o. M. a. C. Resources, Ed., ed. Chonburi, Thailand: Ministry of Natural Resources and Environment, 2010.
- [2] Maria Teresa Siniscalco and N. Auriat, "Questionnaire design," in Quantitative research methods in educational planning, K. N. Ross, Ed., ed Paris, France: UNESCO International Institute for Educational Planning, 2005.
- [3] Mike Brennan and J. Charbonneau, "The Colour Purple: The Effect of Questionnaire Colour on Mail Survey Response Rates," Marketing Bulletin, vol. 16, 2005.
- [4] Sarah Sharples, et al., "Medical device design in context: A model of user-device interaction and consequences," Displays, 2012.
- [5] B.-T. Karsh, "Beyond usability: designing effective technology implementation systems to promote patient safety," Quality & Safety in Health Care, vol. 13, pp. 388-394, 2004.

- [6] P. Tanbunyeun, "The Stress Management of Public Health Personnel in Ban Bueng District, Chon Buri Province " Mater of Public Administration, Graduate School, Valaya Alongkorn Rajabhat University, Pathum Thani Province, 2011.