A causal model of factors affecting azimuth and altitude learning by smart phone in astronomy

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J Wimuttipanya*

Department of General Science, Faculty of Education, Bansomdejchaopraya Rajabhat University, Dhonburi, Bangkok 10600, Thailand

*E-mail address: Jittawisut21@gmail.com

Abstract. In present, physics learning management has developed into learning technology from easy to complex levels with many developed media increased. Smart phone is one of all media use in many automatically. In this paper, researcher used instruction of a causal model of factor affecting azimuth and altitude learning by smart phone in astronomy using by rotating the position, finding the angle of the star in the sky which tells the coordinates of the star from applications created used by cell phones and Wi-Fi. It was suggested that student using their phones to download a free app that would monitor frequencies and send data to a processing facility. Methods for teaching and learning that students have analysed solve problems that are linked to the problems of everyday situations and conclusions through the team's idea to solving problems of inequality in access to quality education of students who are far away and the practice of research practices that can be used to develop educational institutions. The results indicated that the adjusted model was consistent with empirical data. Goodness of fit measures were found to be: χ^2 = 271.59, df = 149, p-value = 0.00063, GFI = 0.95, RMSEA = 0.042.

1. Introduction

Department of General Science, Faculty of Education, Bansomdejchaopraya Rajabhat University realize and aim to promote student potential to capacity of experience and integrated with technology digital (smartphone) for better than convenience of learning. About the inclusion of Learning within a formal learning environments, teacher involvement occupies a fundamental position as has been analyzed in recent works [1]. Concerning physics learning, mobile devices are not only mere intermediate tools between the learner and the teacher or the available contents. Smartphones can also be used for learning physics by allowing the students to do experiments using the smartphones' sensors as measurement devices. [2]. The more interesting result is that a majority of students see mLearning as a very positive experience as they would recommend it (average value at 3.30 of Likert scale) or use again this type of applications (average result). It was also interesting to see their positive opinion on mLearning, as they considered that it facilitates learning (average value 3.5). More details on the results of this survey can be seen elsewhere [3]. We must only provide them with tools that can be used not only to observe, but also to measure so that they can make a more critical thinking to contrast or reassure their knowledge of physics.

Currently most of our students have smartphones that can be used with that aim. Many recent works have shown the utility of free applications that access the smartphones sensors to record measurements of physical quantities in several fields of physics, as mechanics [4]. In science learning, most require visual media or supporting tools to facilitate the understanding of the material especially for materials related to natural phenomena [5]. The practice of pocket mobile learning media can influence the

student's critical thinking ability compared to power point. The students are better engaged and reciprocal as they apply to smartphones and can be handled anytime and anywhere. Technology becomes a powerful learning tool and places students away from the decline of the times [6]. The smartphone, through its small size, ease of use, proliferation of free or cheap apps, and constant connectivity, changes our life in a way that goes well beyond what we experienced with previous media. This study examined smartphone users perception and evaluation of their dependent behavior during the 2014 communication blackout (March 20) that lasted 6 h in South Korea. Based on the interviews with 70 smartphone users between March 22 and March 30, 2014, this study identified two types of dependence-functional dependence which stresses instrumental usefulness of the smartphone and existential dependence which focuses on obsessed, often unconscious, attachment to the smartphone. Although the two types of dependence may overlap each other, those who perceive existential dependence were more reluctant in acknowledging negative aspects of smartphone use than those who perceive functional dependence. In addition, functionally dependent users were more willing to change their dependent behaviors than existentially dependent people. Smartphone users, regardless of their types of dependence, denied that they were addicted to the smartphone [7]. This paper focuses on the blurring boundary between the "human self" and the smartphone, using interviews with 60 heavy smartphone users. The interview responses reveal three types of self-extension via the smartphone-functional extension, anthropomorphic extension, and ontological extension. Smartphone users assert that their phone has become an indispensable part of their self and thus influences their identity and sense of being in both positive and negative ways. The accessibility of online resources in English means that today informal contexts offer a multitude of language development opportunities [8]. The main objective of this paper concern the investigation of smartphone use for the online informal learning of English among undergraduate students in Slovenia. We sampled 296 college students, and administered self-report scales to assess frequency of using various smartphone features, and problematic smartphone use [9]. We also assessed psychopathology constructs (ruminative thinking and emotion regulation deficits) and demographics (age and gender) as potential covariates of smartphone use patterns. The heavy use class scored higher on all problematic smartphone use outcome variables. Results aid in understanding the nature and relation of smartphone usage patterns to psychopathology and problematic smartphone usage [10].

2. Method

This research is the quasi-experiment using the post-test only for control group design. The subjects were students in General Science Education of Bansomdejchaopraya Rajabhat University under the material of physics is azimuth and altitude with smartphone. The number of respondents was 105 students for treatment. The dependent variables applied in this study was critical thinking skills. The independent variable is learning media with smartphone learning. The analysis technique used is the analysis of variance (ANOVA) with a margin of error (alpha) of 5%. The critical thinking skills instrument is evaluation questions with multiple choice. The number of multiple choice are 105 questions. A cross-sectional survey was conducted on both males and females who learning in astronomy subject. Data were collected on April 2018. Data collection was performed by trained research assistants. The specially designed questionnaire used for data collection in this study was pilot tested to calculate approximately the time for questionnaire completion, verify the command of questions by the participants and improve the questionnaire accordingly. These questionnaires were excluded from the concluding analysis. The final self-administered questionnaire included 105 questions and required approximately 5 min to complete. The questions were generally of a closed-ended format, but the choices were remodeled according to the feedback from the pilot questionnaires to make the choices more relevant and appropriate. The questionnaire was composed of two sections. 105 questions were integrated in first section about personal information, such as age, gender, educational level and grade score.

3. Results and discussion

The questionnaire was distributed to 250 students in total, 105 questionnaires were completed, returned, and included in the data analysis, corresponding to a response rate of 100%. The results of confirmatory element analysis (Confirmatory Factor Analysis) with linear structure relationship techniques. The researcher defines the symbols and meanings that are used to represent the main components 3 factors and 19 observations are shown in the table 1.

Table 1. Classification of variable and factors.

	Variables	Factors
Endogenous variable	Student	1) Laboratory: available use to experiment 2) Characteristic: ability in nature of science learning 3) Application: ability use programs on smartphone in learning 4) Practice: available of skills in use program 5) Environment: building value across the resource learning
Exogenous variable	Scenario	6) Accurate: right of the data subject 7) Fast: immediately of the data subject by short term memory 8) Precise: least error in a subject by long term memory
	Knowledge	9) Factuality: understanding of based on fact 10) Conceptual: understanding of data information 11) Procedure: available to learning procedures 12) Achievement: have a knowledge development 13) Construction: pioneer by themself
	Analytic	14) Description: available to knowledge transmission and construction 15) Performance: ability to compere distinguish and classify of data information 16) Innovation: adaptability of technology creation for convenience 17) Invention: ability explorer to inventor and collect receivable 18) Presentation: applied to special types of data and technology design process 19) Assessment: types of result evaluation methods

The survey result of factor affecting azimuth and altitude learning by smartphone in astronomy are shown in the table 2. The factors consist of laboratory characteristic application practice environment accurate fast precise factuality procedure achievement construction description performance innovation invention presentation and assessment. However, the idea of astronomy are the most importance integrated with smartphone learning.

Table 2. Reliability of factor affecting azimuth and altitude learning by smartphone in astronomy.

Variable	Factor	Cronbach's Alpha	Value	
			Mean	Std. Deviation
Student	Laboratory	0.864	4.57	0.73
	Characteristic	0.857	4.63	0.66
	Application	0.844	4.52	0.58
	Practice	0.832	4.58	0.74
	Environment	0.821	4.68	0.47
Scenario	Accurate	0.805	4.66	0.63
	Fast	0.775	4.51	0.55
	Precise	0.764	4.53	0.64
Knowledge	Factuality	0.758	4.75	0.73
	Conceptual	0.756	4.68	0.47
	Procedure	0.752	4.63	0.66
	Achievement	0.746	4.85	0.66
	Construction	0.742	4.77	0.46
Analytic	Description	0.740	4.65	0.42
	Performance	0.738	4.57	0.73
	Innovation	0.731	4.55	0.61
	Invention	0.727	4.75	0.73
	Presentation	0.720	4.67	0.68
	Assessment	0.713	4.63	0.66

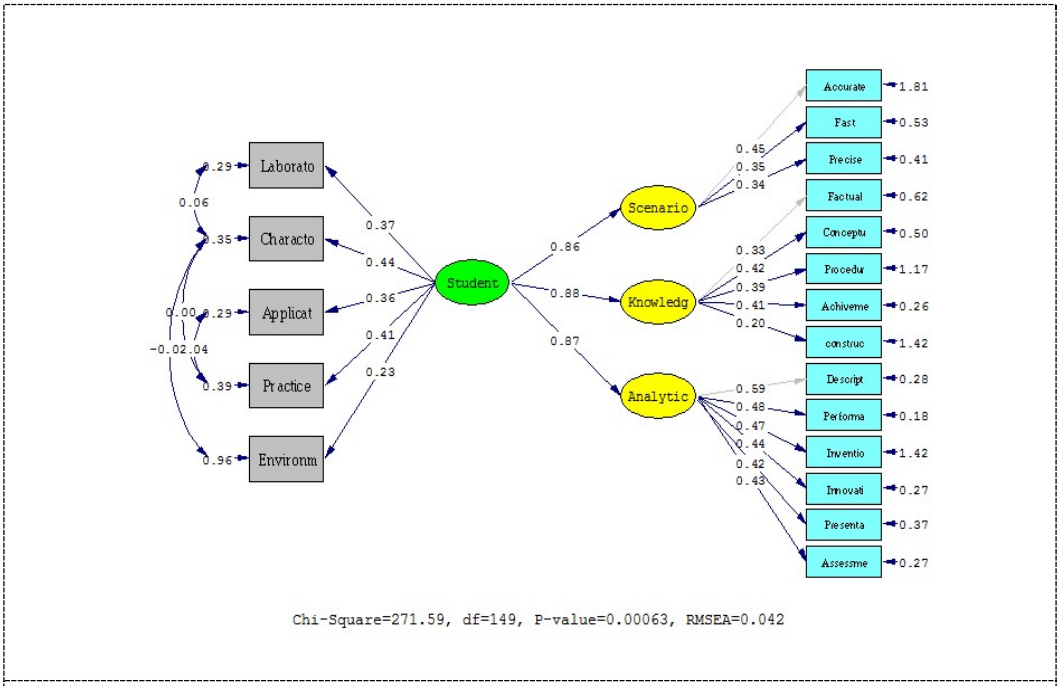

Figure 1. The causal model of factor affecting azimuth and altitude learning by smartphone in astronomy.

The Reliability of factor loading and communality azimuth and altitude learning by smartphone in astronomy are shown in the table 2 that presents the factor loadings and communalities. According to Henson R and Roberts J K [11], "the meaningfulness of the latent factors is ultimately dependent on researcher's definition". Pett M A *et al* [12] emphasizes that the naming of the factors is a subjective, inductive, and theoretical process. For this reason, both items of each factor and the related literature are considered to name factors suitably.

The factor affecting azimuth and altitude learning by smart phone in astronomy are shown in the table 3 presents the factor affecting. The variables consist of Student Scenario Knowledge and Analytic, both items of each factor and the related literature are considered to name factors suitably.

Table 3. The factor affecting azimuth and altitude learning by smart phone in astronomy.

			Value	
Variable	Factor	N	Factor loading	Communality
Student	Laboratory	105	0.374	0.455
	Characteristic	105	0.446	0.484
	Application	105	0.367	0.485
	Practice	105	0.417	0.562
	Environment	105	0.238	0.337
Scenario	Accurate	105	0.457	0.488
	Fast	105	0.352	0.463
	Precise	105	0.346	0.472
Knowledge	Factuality	105	0.338	0.466
	Conceptual	105	0.426	0.583
	Procedure	105	0.395	0.481
	Achievement	105	0.418	0.538
	Construction	105	0.206	0.351
Analytic	Description	105	0.596	0.542
	Performance	105	0.483	0.479
	Innovation	105	0.473	0.462
	Invention	105	0.447	0.584
	Presentation	105	0.427	0.415
	Assessment	105	0.435	0.473

The factor loading and communality azimuth and altitude learning by smart phone in astronomy are shown in the figure 1. The causal model of factor affecting azimuth and altitude learning by smart phone in astronomy consist of 3 factors and 19 observations. The endogenous variable (student) includes five factors with factor loadings of at least 0.23. The factors are laboratory characteristic application and practice. The exogenous variable (Scenario, Knowledge, Analytic) includes fourteen factors with factor loadings of at least 0.20. The factors are accurate fast precise factuality conceptual procedure achievement construction description performance innovation invention presentation and assessment. The results indicated that the adjusted model was consistent with empirical data. Goodness of fit measures were found to be χ^2 = 271.59, df = 149, p-value = 0.00063, GFI = 0.95 and RMSEA = 0.042. The variables in adjusted model accounted for 90 percent of the variance in affecting azimuth and altitude learning by smart phone in astronomy.

The reliability and factor affecting of factor loading and communality azimuth and altitude learning by smartphone in astronomy. The variables consist of Student Scenario Knowledge and Analytic, both items of each factor and the related literature are considered to name factors suitably.presents the factor loadings and communalities. According to Henson and Roberts [11], "the meaningfulness of the latent factors is ultimately dependent on researcher's definition". Pett M A *et al* [12] emphasizes that the naming of the factors is a subjective, inductive, and theoretical process both items of each factor and the related literature are considered to name factors suitably. The causal model of factor affecting azimuth

and altitude learning by smart phone in astronomy consist of 3 factors and 19 observations. The endogenous variable (student) includes five factors with factor loadings of at least 0.23. The factors are laboratory characteristic application and practice. The exogenous variable (Scenario, Knowledge, Analytic) includes fourteen factors with factor loadings of at least 0.20. The factors are accurate fast precise factuality conceptual procedure achievement construction description performance innovation invention presentation and assessment as like the open innovation that is known as the use of purposive inflows and outflows of knowledge with a view to accelerate firms' own internal innovation, and expand the markets through external use of innovation is a very important window of opportunity for all firms to keep up with technology and survive [13].

4. Conclusion

A causal model of factor affecting azimuth and altitude learning by smart phone in astronomy according to the guidelines of general science section to enhance the potential for teachers, school administrators and educational personnel in managing adaptation of digital technology and science learning of students at the grade level 1-3 in an opportunity extension school or a middle school that is far away to promote analytical thinking skills inquiry-based learning management creativity including obtaining the content, subjects and knowledge that are of the age to focus on creating a good foundation for mathematics and science education to advance employment in digital technology related careers, developing instructional media and introducing methods for teaching and learning that students have analysed solve problems that are linked to the problems of everyday situations. Interact work as a team and able to communicate the conclusions through the team's idea which is a learning management model that is consistent with international standards which will lead to solving problems of inequality in access to quality education of students who are far away and the practice of research practices that can be used to develop educational institutions.

Acknowledgments

The author wishes to thank Chevron Enjoy Science Project and Kenan Foundation Asia. Directorate General of Science. Our thanks to the president and Director of Research Institute of Bansomdejchaopraya Rajabhat University they had supported a scholarship and research development for sustainable.

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