

Self-efficacy, Self-reliance, and Motivation in an Asynchronous Learning Environment

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Abstract—Self-efficacy, self-reliance, and motivation were examined in a quasi-experimental study with 178 sophomore university students. Participants used an interactive cardiovascular anatomy and physiology CD-ROM, and completed a 15-item questionnaire. Reliability of the questionnaire was established using Cronbach's alpha. Post-tests and course grades were examined using a t-test, demonstrating no significance. Results of an item-to-item analysis of the questionnaire showed overall satisfaction with the teaching methodology and varied results for self-efficacy, self-reliance, and motivation. Kendall's Tau was calculated for all items in the questionnaire.

Keywords—Asynchronous learning environments, motivation, self-efficacy, self-reliance.

I. INTRODUCTION

NO longer is there a debate in education as to the need for integration of technology enhanced learning tools into the curriculum. Technology enhanced learning incorporates a wide range of activities such as basic word processing to complex asynchronous learning environments (ALE). ALE is an electronic learning environment that takes place in different time frames and at the learner's convenience. These learning environments may include blogs, interactive computer software, or simulations. Educational institutions must prepare students to function effectively in the healthcare arena that reflects the embracement of the technology revolution by society. However, the primary goal is to provide the direction for students to think critically and problem solve complex healthcare situations. Technology allows educators to provide varied learning opportunities and to design non-linear learning activities that more closely emulate the healthcare arena.

Research literature supports that ALE, compared to traditional lecture/textbook methods, results in cognitive gains; therefore, the purpose of this study is to investigate the impact of an ALE on learning, specifically, a faculty authored CD-ROM, Cardiovascular Anatomy and Physiology. The CD-ROM, designed using Gagne's [1] instructional principles incorporates a hypermedia, non-linear format that allowed

students to determine the sequencing and type of instructional method desired [2].

For this study, the concepts of self-efficacy, self-reliance, and motivation were used to examine learner independence, satisfaction, and performance in an ALE, the cardiovascular CD-ROM. Course grades were examined to determine correlation with post-tests.

II. LITERATURE REVIEW

A. Theoretical Framework

Bandura's [3] theory of behavioral change with the concept of self-efficacy, guided the theoretical model for this study. Bandura defined self-efficacy expectation as "the conviction that one can successfully execute the behavior required to produce the outcome" (p. 193). Maier and Curtin's [4] study with math-phobic journalism students suggested, "The belief in one's personal capabilities is central to how a person responds to tasks" (p. 361). Thus, not only are cognitive skills mandatory, but a belief that one can translate these to outcome performance.

The expectation of accomplishment is not the only factor encouraging behavior and performance [3] Self-efficacy influences one's motivation for academic growth [5], [6]. By extension, self-reliance or dependence on one's own initiatives, pairs with self-efficacy. If the student lacks the knowledge, skills, resources, or opportunities, self-efficacy is not sufficient to motivate the performance of a behavior. The strength of the student's convictions as to the success of the behavior or performance, will affect whether the behavior is initiated as well as the persistence. For example, a student who perceives cardiovascular anatomy and physiology as too complex and difficult to understand, may choose to memorize the terminology of cardiac structure but not persist in understanding the physiology of how these structures function. Thus, the perceptions hinder the student's ability to answer application and critical thinking questions about cardiovascular content.

Research indicates a positive relationship between self-efficacy and student motivation [7]-[9]. Bandura's [3] instructional strategies and Gagne's [1] nine classical principles offers a sound, logically organized, and motivational instructional design model influencing self-reliance and self-efficacy [9].

B. Asynchronous Learning Environments

Many educators cling to traditional lecture/textbook methods for learning. Earlier meta-analysis and subsequent

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research studies identified that students' using technology enhanced learning demonstrated cognitive gains of at least equal to [10]-[15] or even greater than students' learning with traditional classroom methods [16]. The most consistent, significant result of using technology-enhanced learning was decreased student learning time [17], [18].

Williams and Brown [19] suggested that research of computer-assisted instruction compared to classroom instruction is "no longer particularly meaningful." Rather, research would be beneficial focusing on the impact of technology integration on learning. The changing teaching-learning paradigm suggests that teaching strategies must be explored that shift the emphasis from teaching to learning, encouraging students to be active participants in the learning process. Innovative teaching, shifting from passive lecture/textbook presentations to incorporation of active learning with integration of technology-enhanced learning into curricula, is needed.

Educators are challenged to integrate the rapid advances in development and application of computer technology into curriculum. The inclusion of technology in curricula is necessary to prepare students for the demands placed on them in the practice arena [20]. Teaching in an innovative learning environment, such as ALE, encourages students to participate actively in the learning process, problem solve, and develop lifelong learning skills [21]. As students increase their cognitive knowledge, skills, resources, and opportunities, motivation to perform the behavior is more likely [22]

III. METHODS

Participants in the study were second year, nursing students enrolled in a pediatric course in an Associate Degree of Science program at a public state supported, Midwest university with an enrollment of 12,000 students. Participants had previously passed two basic anatomy and physiology courses as well as two medical-surgical courses which contained cardiovascular content. All participants earned a grade of C or better in each of the previous courses.

The 178 participants experienced the interactive Cardiovascular Anatomy and Physiology CD-ROM as part of the requirements within the curriculum requisite pediatric course. The CD-ROM had not been used in previous courses. Completion of the CD-ROM's pre and post-tests were required. The Attitudes Toward Instructional Methodology Questionnaire (ATIMQ) was distributed to all students. Faculty informed the students of their rights and anonymity was assured. Anonymity of the participants in the study was maintained by coded numbering of the data. Following protocol of Purdue University, there was no effect on a student grade for participation or non-participation.

Students self-selected participation. Randomization was not used. It was explained to participants that the questionnaire had a series of statements about personal attitudes towards learner satisfaction and self-efficacy/self-reliance/motivation in learning when participating in asynchronous learning environments. It was noted that they may agree with some of the statements and disagree with others, but that there were no right or wrong answers.

There were no known risks in the study. Increased knowledge of the cardiovascular anatomy and physiology, which may be useful in understanding cardiovascular content, was described to the participants as a potential benefit. Confidentiality of the study's results was emphasized and all students signed informed consents which described the study in full. Approval for the study was granted by the Purdue University Committee on the use of Human Research Subjects.

IV. DATA COLLECTION

The participants completed the CD's pre-test, interactive, nonlinear content, post-test, and the ATIMQ. The CD was placed on the university server system, providing access to the participants from any campus computer location. The results of the pre-test and post-test were printed by each participant and submitted to the respective course professors by the week prior to the completion of the courses. Participants submitted the completed ATIMQ in a collection box not viewable by the principal investigators or the course faculty. Data were collected over a 14-week period during six different semesters.

A. Instrument

A 15-item questionnaire, ATIMQ measured satisfaction with teaching methodology and self-efficacy/self-reliance/motivation in learning. One question obtained demographic information, two asked participants if they used the extra functions such as the notebook and the glossary, and two queried what was best liked and disliked about the interactive CDs. The remaining 10 items were ground in Bandura's [3] self-efficacy theory and utilized a 5 point Likert-type format on a continuum of strongly disagree to strongly agree. Four items queried satisfaction with teaching methodology with an internal consistency, as measured by Cronbach's alpha, of 0.89. Self-efficacy/self-reliance/motivation was queried with six items. Item number 10, "It is the teacher's responsibility to tell me what I need to learn," had a negative choice as high response. The item was recoded before statistical analysis so that a higher score indicated a positive response. The Cronbach's alpha coefficient was 0.56. The internal consistency could be improved to 0.69 when the item, "It is the teacher's responsibility to tell me what I need to learn," was eliminated. The internal consistency for the total scale, calculated after deleting item 10 was 0.83.

V. RESULTS

A. Participants

Approximately 50% of the class population participated in the study. Of the 178 students who completed the ATIMQ questionnaire, 173 identified demographic information. Most of the students were female (91.7%), white (96%), and 17-34 years of age (See Table I).

TABLE I
 DEMOGRAPHICS OF PARTICIPANTS

Categories	Cardiovascular A&P (n=173)
Age	Percent
17 – 25	36.7
26 – 34	36.7
35 – 44	21.9
45 – 54	4.4
over 55	0.6
Race	
American Indian	0.6
Asian	0.6
Black (not Hispanic)	1.9
White (not Hispanic)	96.2
Other	0.6
Gender	
Female	91.7
Male	8.3

B. Pre and Post Tests

The pre-tests and post-tests contained identical, 30-item, multiple-choice questions. The questions were written at application level, using the Bloom's revised taxonomy [23]. Table II displays the testing results for six semesters. There was significant difference between Spring 2003 and Spring 2005 pre-test and post-test scores ($p \leq .0000$); however, there was no significant difference in course grades. Overall, course grades were not significantly related to post-tests.

TABLE II
 PRE AND POST TEST MEANS

Semester	Pre test	Post test	Gain
Spring 2003	69.9 (n=30)	86.5	16.6
Summer 2003	78.9 (n=16)	92.5	13.6
Fall 2003	74.4 (n=30)	89.2	14.8
Spring 2004	70.6 (n=31)	87	16.4
Fall 2004	78.3 (n=33)	92.8	14.5
Spring 2005	84.5 (n=38)	94.1	9.6

C. ATIMQ

An item-to-item analysis of each ATIMQ question was completed using descriptive statistics. The results showed that the participants were satisfied with the teaching methodology; however, one item, "CD is consistent with the way I like to learn" reported only 56% as agree/strongly agree. The remaining three items from satisfaction with the teaching methodology ranged from 68% - 86% as agree/strongly agree.

The analysis of the self-efficacy/self-reliance/motivation concept(s), demonstrated varied results. Three of the items, numbers 6, 7, and 8 ranged from 71%-83% as agree/strongly agree. However, the responses for items 5, 9, and 10 ranged from 48%-56% as agree/strongly agree. The responses of undecided, agree, and strongly agree of 10 item, "It is the teacher's responsibility to tell me what I need to learn," totaled 74%, indicating low self-reliance in learning.

TABLE III
 ATTITUDES TOWARD INSTRUCTIONAL METHODOLOGY QUESTIONNAIRE RESULTS

Response Items	Range	X _̄	S
Satisfaction with Teaching Methodology			
1. The graphics used in the CD help me visualize the content	2- 5	4.03	.688
2. The CD provides an effective method of learning	2-5	3.89	.763
3. I enjoy the format of the CD	1-5	3.72	.849
4. Using the CD is consistent with the way I like to learn	1 - 5	3.43	1.007
Self-efficacy/Self-reliance/Motivation			
5. I am confident that I am mastering cardiovascular anatomy and physiology content	2 - 5	3.53	.730
6. I am confident that I am developing the knowledge needed to become a good health professional	2-5	3.92	.567
7. I am confident that I am developing the skills needed to become a good health professional	2 – 5	3.92	.588
8. I do well on the pre-post-tests on this CD	2-5	3.64	.901
9. Presentation of information is motivating	1-5	3.46	.871
10. It is the teacher's responsibility to tell me what I need to learn	1-5	3.30	1.023

Kendall's Tau, for ordinal data, was performed to examine the relationship of the ATIMQ variables. Table IV displays the results ($p \leq .01$). Two items, pre and post-tests and teacher's responsibility, did not demonstrate significance.

TABLE IV
CORRELATION OF QUESTIONNAIRE ITEMS

Variables	G	E	F	C	AP	K	S	M
Graphics help visualize (G)		.548**	.460*	.404**	.149**	.190**	.216**	.410**
Provides effective learning (E)			.622**	.555**	.192**	.192**	.278**	.630**
Enjoy the format of the CD (F)				.581**	.276**	.224**	.196**	.650**
Consistent with way I learn (C)					.176**	.197**	.191**	.664**
Mastering A & P content (AP)						.458**	.352**	.174**
Developing knowledge (K)							.771**	.197**
Developing skills (S)								.191**
Presentation motivating (M)								

**p ≤ .01

D. Learner Feedback

The responses to the two questions soliciting the participants' favorable (like) and non-favorable (dislike) perceptions of the CD were thematically analyzed. The results are displayed in Table V.

TABLE V
PARTICIPANTS COMMENTS REGARDING CD

Like	Dislike
Rationales for answers	Non-linear
Graphics	Prefer lecture
Facilitates content review	Time consuming
Ease of use	Navigation
Pre and post-tests	Access limited to campus

VI. DISCUSSION

A. Implications

After completing two courses in basic anatomy and physiology and two medical-surgical nursing courses, the pre-test scores were extremely low. This may be related to lack of risk/benefit identified by the participants; therefore, they spent little effort in analyzing the questions. The scores on the post-test did not affect their course grades, so while the results significantly improved; the increased scores did not reach the level of expectation of the researchers.

While learning styles are believed to be an important consideration in the design of learning material, participants in this study performed equally well on the post-test regardless of how they responded to the item, "The CD as consistent with the way I like to learn."

Few students in this study identified that learning was self-responsibility; thus, a cause for concern to educators who believe that learning should be self-directed. Much is being written about leaving the sage on the stage; yet, the participants have not embraced self-reliance. The low scores (56% agree/strongly agree) for confidence in mastering CD content and the high scores (82%-83%) identified with developing knowledge and skills are incongruent. Only 50% of the participants agreed that the presentation on the CD was motivating; however, visualizing the content using the

graphics scored high as did the effectiveness of the CD method of learning. The design of the CD was non-linear, and learner controlled with extensive animations and graphics. The participants' perception of "presentation of information is motivating" needs further exploration.

An electronic notebook and glossary were embedded in the CD; yet, few participants reported using the aids. Participants, who do not prefer e-learning, may choose non-electronic methods of keeping notes. Printed sources for defining or clarifying vocabulary may also be preferred. Because the participants were not queried regarding their use of alternate sources for note keeping or vocabulary reference, questions remain whether students actually use resources that are made available.

B. Limitations

The participants were drawn from a homogenous population; little diversity exists in the student body. Greater diversity, particularly in race and gender, is need in future studies. Item number 8, performance on the pre and post-test s needs to be separated into two items to allow participants to identify differences in pre and post-testing. Replication of the study in other populations will make the findings more generalizable.

VII. CONCLUSION

The infusion of technology in education no longer be debated or ignored. The question is not if students learn in ALE, rather the question must be asked, what is the optimal use of technology to promote self-efficacy, self-reliance, and motivation resulting in increased knowledge?

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