British Journal of Education, Society & Behavioural Science
12(1): 1-6, 2016, Article no.BJESBS.20259
ISSN: 2278-0998

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Physics Achievement from the Perspective of Learning Style Preferences

Maher M. Al-arfaj[1*]

[1]*King Faisal University, College of Education, P.O.Box 55127, Hofuf 31982, Saudi Arabia.*

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/BJESBS/2016/20259
Editor(s):
(1) Doutora Laurinda Leite, Institute of Education, University of Minho, Portugal.
(2) Tsung Hung Lee, Graduate School of Leisure and Exercise Studies, National Yunlin University of Science & Technology, Taiwan.
(3) James P. Concannon, Associate Professor of Education, Westminster College, Fulton, Missouri, USA.
Reviewers:
(1) Barry Chametzky, Ozarks Technical Community College, USA.
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(3) Ahmed A. Najim, Palestine University, Gaza, Palestine.
Complete Peer review History: http://sciencedomain.org/review-history/11426

Short Research Article

Received 19th July 2015
Accepted 2nd September 2015
Published 16th September 2015

ABSTRACT

Learning styles are personal pathways that articulate processing incoming information. The learning style of an individual could facilitate instructional operations to understand different subjects, and define remedies to improve performance in these subjects. Consequently, this study is raising the question: is there a significant difference on students' learning styles with respect to their achievement in physics?

The productivity Environmental Preference Survey (PEPS) was translated into Arabic and used after being checked for validity and reliability on an actual sample of 89 tenth grade participants from four schools in Al-hassa district. The results revealed that emotional and sociological learning style preferences turn significant differences with respect to physics achievement. Although that the environmental and physiological learning preferences showed non-significant results, individual components encompassed in these two learning stimuli may bear considerable indications.

Keywords: Learning styles; preference survey; physics; achievement.

**Corresponding author: E-mail: teachingmethods@yahoo.com;*

1. INTRODUCTION

An important task of practitioners in the field of teaching is to guide our students' learning behavior. While there is an overwhelming literature on learning and recommendations to earn success in different subjects, understanding insightfully this process is sophisticated. Learning occurs through intended and non-intended operations. Therefore, a significant instructional design should be tailored to correspond to how students learn, and process information. This premise has encouraged several teachers to embed natural pathways within their instructional designs to enhance students' natural learning. Illumination of learning styles as ways corresponding to brain functionality may enhance the endeavor of students' learning. Dunn (1990) defined a learning style as the pathway each learner conducts to absorb, treat, and recall perceived information [1].

Identifying students' learning styles and then tailoring instruction to them may enhance learning, and improve achievement in different subjects. In physics, a considerable effort has been invested to guide students' learning. Different studies have looked at possessed physics' concepts, and how to resituate them. However, most of the literature on physics teaching and learning appears to endorse general indications rather than empirical reliable applications.

Understanding that each learner is unique, a learning style is a reflection of a biological and personal set of characteristics that distinguish students. Dunn (1990) proclaimed that learning styles unveil why teaching is effective for some students and not for the others [1,2]. Assessing students' learning styles is vital to the teaching/learning process, as well as, it could give indications of the best match between a learning preference and type of the studied subject. The aim of this study therefore is supported to highlight the interactivity between students' learning preferences and their achievement in physics.

1.1 Statement of the Problem

Learning is a sophisticated process occurring in the brain to adapt incoming information into existed mental structures and to overcome confronted situations. Learning styles are personal pathways that articulate these processes, and illuminate an individual's pattern of behavior. The learning style of an individual could facilitate instructional operations to understand different subjects, and define remedies to improve performance in these subjects. Furthermore, a student's learning style may determine his/her suitability to pursue a study in certain subjects. Consequently, this study is raising the question: is there a significant difference on students achievement in physics with respect to learning styles?

1.2 Theoretical Framework

Learners tend to demonstrate patterns in the way that they deal with confronted situations. These patterns are constructed by the interaction of different parameters. Dunn (1990) calls such patterns as learning styles, and assert that these patterns vary from person to another [1,2]. A learner will learn effectively when a learning situation is constructed according to his/her learning style. Hence, a learning preference could be assimilated into a learning style model of instruction encompassing all interactional elements.

Dunn and Dunn identify twenty elements falling into four strands that collectively assemble a model of learning [2,3]. The environmental strand describes the physical parameters of a learning situation such as: sound, light, temperature, and seating designs. While the emotional strand prevails, a learner's involvement with a learning situation exists. This involvement includes motivation, persistence, responsibility, and guided structure. The sociological strand likely reflects the preferred status of learning a material; whether working alone or in a group, with a supervision of an adult or cooperating with a friend, and with flexible structural steps or a well-defined routine. Moreover, the physiological strand represents perceptual preferences in a learning situation such as: visual or verbal senses, intake food or drink while doing a work, preferred certain time to accomplish a task, and mobility [3].

Gary Price developed a learning style inventory, which identifies the twenty characteristics that affect how students learn, and figures out each student's individual learning style preference. The Productivity Environmental Preference Survey (PEPS) can be utilized as a discriminator that allows instructors to capitalize on students' learning style preferences. The PEPS instrument tracks individual and collective group learning styles to design teaching strategies accordingly. It is a call to stem models of instruction out of students' learning style preferences.

Hawk and Shah [4] examined the Dunn and Dunn model, and learning styles inventories including PEPS instrument in terms of validity and reliability. They claimed a solid support of the instrument's validity and reliability, and advocated the significant outcomes of the manifestation of these inventories with students.

As learning styles inventories turned to be as valid and reliable, different researchers sought to find the impact of learning styles on academic achievement. As a result, several studies have shown that students' academic performance is associated to their learning styles [5]. In contrast, Almigbal (2015) conducted a study on a sample of King Saud medical college in Saudi Arabia, and has found no relationship between learning style preference and academic achievement [6]. Similarly, an Indian study conducted on undergraduate medical students found no statistical association between learning style preferences and academic performance based on grades [7].

Given the diversity of different disciplinary fields, a growing body of research has focused on learning style preferences according to hard or soft, pure or applied, concrete or abstract, and active or reflective area of study. Taking into consideration the nature of each discipline, students' achievement could interact accordingly with their learning style preferences.

2. METHODOLOGY

The main objective of this study was to look at the variations of students' learning styles with respect to their achievement in physics. The purpose was met by administering the PEPS instrument, and collecting the students' scores in the first term examination for the academic year 2014/2015 in four urban high schools.

All participants reviewed the student cover letter that explained the nature of the research and provided opportunity for informed consent. In addition, all instructions were reviewed with participants to correctly complete the inventory, and avoid any ambiguity. After responding to the inventory, raw scores were obtained for each of the learning style category and sub-category according to the directions of the PEPS scoring procedures.

Details concerning the study sample and instrument validity and reliability were discussed. In addition, the adapted statistical procedures were compatible with the research design, and suitable to draw inferences associated with the research question.

2.1 Sample

The study was conducted in the Al-hassa province of Saudi Arabia with a total of 89 tenth grade male students. The convenience sample represented 4 high schools in the urban area during the second semester of the academic year 2014/2015.

2.2 Instrument Validity and Reliability

The cross-cultural validation was adopted to assure the usability of this instrument in an Arabic community. The translation and adaptation of the PEPS instrument were undertaken by following rigorous steps suggested by Sperber, Devellis, and Boehlecke [8] to adhere the cultural relevancy and sensibility, and assuring the original meaning. The original instrument was first translated into Arabic by a bilingual educator fluent in both English and Arabic. Then, the Arabic version of the instrument was back-translated to English by an independent educator in Saudi Arabia also fluent in English [8].

Following the translations, the original and the back-translated versions of the instrument were compared and evaluated in terms of language form, and meaning. Comparability of language was regarded as the formal similarity of words, phrases, sentences, and similarity of interpretability was considered as the extent to which the two versions would invoke the same attitude response even if the wording were slightly different. For this purpose, an evaluation form on both dimensions (language and meaning) with a three-point Likert-type scale ('comparable', 'neutral', and 'not comparable') was prepared for the original-back-translated item pairs.

The comparability of the items in terms of language and meaning was performed by two fluent English speakers. Outlined scores were averaged and decisions were taken for any further reconsideration. Based on the comparability evaluation, six items were retranslated for both meaning and language, and eleven items were revised for only language. In the final stage of development, the instrument was evaluated by a faculty at the department of curriculum and instruction at King Faisal University in terms of suitability within the Saudi context. His feedback was utilized to improve the items and avoid any additional ambiguities.

To cross-validate the structures of the PEPS for the present sample, the scales were subjected to factor analyses. The factor analysis of the PEPS scale yielded that factor loadings of the items ranging from 0.63 to 0.91, and a total of 71% of the variance being explained. The internal consistency reliability coefficient (Cronbach's Alpha) for the component was computed as 0.83 indicating that the instrument was internally highly consistent.

2.3 Statistical Procedures

The two main variables in this study are achievement in Physics and learning preferences. The physics achievement was instantiated as the z-mean score on the final first semester exam. Since this exam is not unified among the 4 selected schools, the z-scores are calculated relatively to each group, which does not take the same test. The scores were coded into two levels, standard scores (z-scores) smaller than "0" (coded as 1) reflected low physics achievement. In opposite, standard scores (z-scores) greater than "0" (coded as 2) reflected high physics achievement. Moreover, the preferred learning style preferences of the students were associated with the mean score of the learning style/ dimension on the PEPS instrument.

Descriptive statistical analyses were performed including frequency distributions and average measures. Differential analysis was also employed to find out the difference between various patterns of learning preferences. Independent t-test was carried out to report any significant differences between high and low academic achievers on the PEPS scores and relatively to the four discriminate areas.

3. RESULTS

The independent t-test clearly inferred that the mean value of the environmental domain is not statistically significant. The high academic achievers have apparently favored the environmental elements (mean = 22.24) as same as low academic achievers (mean = 21.8). This may be due to the adaptation process that students have developed over time; students had experienced probably different types of learning settings that enabled them to cope with any environmental changes. In addition, the nature of physics involves a lot of thinking manipulations that could conform the ultimate outcome, and may not be drastically impacted by environmental inputs.

The independent t-test showed a statistical privilege between the two types of achievers with regard to the emotional domain. High achievers have scored greater scores (mean = 23.46) than low achievers in the emotional domain (mean = 20.1); the mean value of high achievers reflects a profound proposition in motivation, persistence, responsibility, and structure. It could be inferred that this stand may be necessary to study physics as most of its learning situations involve such emotional tendencies for success endeavors. The associated effect size on this domain was very large (d_{Cohen} = 1.1) revealing a 58% overlap between the two groups (the higher and lower achievers), and indicating that a 78% chance that a person selected at random from the high achieving group will more favor the emotional learning style preference from the low achieving group.

The sociological domain has also participated significantly in differentiating between high and low achievers. The independent t-test unveiled that the two types of achievers were impacted by sociological patterns; however, no definite pattern was articulated. In general, the low achieving students showed a greater mean value with correspondence to sociological elements (mean = 18.79) than high achieving students (mean = 16.24). This may be justified that high achievers may have more confident to interact with physics under various sociological circumstances, while low achievers may have less confident to interact with physics leading them to favor the sociological impact. The associated effect size on this domain was large (d_{Cohen} =0.8) revealing a 69% overlap between the two groups (the higher and lower achievers), and indicating that a 71% chance that a person selected at random from the high achieving group will more favor the sociological learning style preference from the low achieving group.

The physiological domain has lastly shown that there was no significant t-value difference between the two types of academic achievers. The independent t-test supported that there was no statistical difference between the high and low

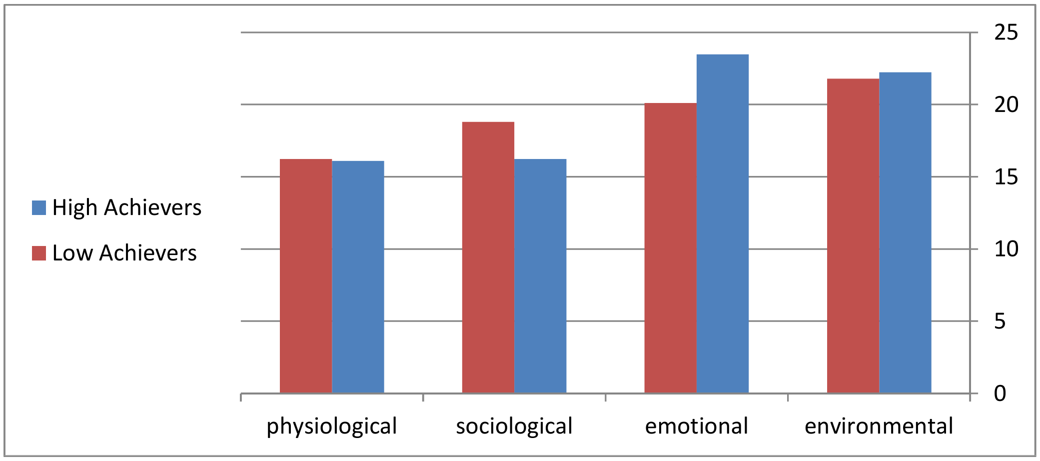

Chart 1. Means of high and low achievers with respect to learning style preferences

Table 1. Independent t-test values and significant difference indications

Dimension	Achievement	N	Mean	Std. D	t	Sig.	d_{Cohen}
Environmental (Noise, Light, Temperature, Seating Design)	High Low	37 52	22.24 21.8	2.01 2.34	.95	.376	0.2
Emotional (Motivation, Persistence, Responsibility, Structure)	High Low	37 52	23.46 20.1	3.1 2.76	5.2	.000***	1.1
Sociological (Learning Alone, Peer Orientation, Authority Figures Present)	High Low	37 52	16.24 18.79	3.44 3.12	-3.5	.000***	0.8
Physiological (Auditory, Visual, Kinesthetic, Requires Intake, Evening-Morning, Late Morning, Afternoon, Needs Mobility)	High Low	37 52	16.11 16.23	2.12 1.89	-0.27	0.78	0.06

achievers' mean values based on the collective physiological elements (means= 16.11 ‹16.23). This could be verified that integrative physiological elements may have no impact on studying physics; however, a single element within this preference may become as a considerable discriminate between the two types of achievers.

4. CONCLUSION

The independent- t test showed a significant difference between high and low physics achievers regarding to emotional stimuli of learning style preferences. Cultivated scores on motivation, persistence, responsibility, and structure could be considered as a venerable discriminate learning style preference between high and low physics achievers. Though bounded scores of the emotional elements showed significant results, one or more of these elements could be independently with less impact. This result is supported by succinct studies enlightening the association between achievement and effortful control components including emotional variables. Although these studies regarded the emotional paradigm according to different bounds of elements, an overall indicatory of an association between positive dispositional emotions and academic achievement was reported [9].

Likewise, sociological elements formed a significant difference between the two types of physics achievers. One or more of these elements may have participated with less impact; however, they all turned out a significant result. In fact, significance presence of sociological learning preference components may have an impact on achievement as students vary by favoring more or less structure [10]. The variance of students' sociological learning preference is considered, but more replicate results are needed to understand the interactivity with achievement on physics [10].

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Dunn R. Rita Dunn answers questions on learning styles. Educational Leadership. 1990;48(2):15–19.
2. Dunn R. Understanding the Dunn and Dunn learning styles model and the need for individual diagnosis and prescription. Reading, Writing and Learning Disabilities. 1990;6(3):223–247.
3. Islam M. The impacts of nation on employees' learning style preferences: A Taiwan-India perspective; 2007. Available:http://ethesys.lib.mcu.edu.tw/ETD-db/ETD-search/view_etd?URN=etd-0820107-165029 (Accessed 3 October 2014).
4. Hawk T, Shah A. Using learning style instruments to enhance student learning. Decision Sciences Journal of Innovative Education. 2007;5(1):1-19.
5. Rasimah A, Zurina M. Students' learning styles and academic performance. In Proceedings of the Annual SAS Malaysia Forum; 2008.
6. Almiqbal Th. Relationship between the learning style preferences of medical students NS academic ahievement. Saudi Medical Journal. 2015;36(3):349-355.
7. Urval RP, Kamath A, Ullal S, Shenoy AK, Shenoy N, Udupa LA. Assessment of learning styles of undergraduate medical students using the VARK questionnaire and the influence of sex and academic performance. Adv Phsiol Educ. 2014; 38(3):216-220.
8. Sperber A, Devellis F, Boehlecke B. Cross-cultural translation: Methodology and validation. Journal of Cross-Cultural Psychology. 1994;25:501-524.
9. Valiente C, Swanson J, Eisenberg N. Linking students' emotions and academic achievement: When and why emotions matter. Child Dev. Perspectives. 2012; 6(2):129-135.
10. Dunn R. Research on the Dunn and Dunn model of learning styles. Jamaica, NY: St. John's University; 2003.

Peer-review history:
The peer review history for this paper can be accessed here:
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