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Major Contribution/Research Article

Association of Kinesthetic and Read-Write Learner with Deep Approach Learning and Academic Achievement

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Abstract

Background: The main purpose of the present study was to further investigate study processes, learning styles, and academic achievement in medical students.

Methods: A total of 214 (mean age 22.5 years) first and second year students - preclinical years - at the Asian Institute of Medical Science and Technology (AIMST) University School of Medicine, in Malaysia participated. There were 119 women (55.6%) and 95 men (44.4%). Biggs questionnaire for determining learning approaches and the VARK questionnaire for determining learning styles were used. These were compared to the student's performance in the assessment examinations.

Results: The major findings were 1) the majority of students prefer to study alone, 2) most students employ a superficial study approach, and 3) students with high kinesthetic and read-write scores performed better on examinations and approached the subject by deep approach method compared to students with low scores. Furthermore, there was a correlation between superficial approach scores and visual learner's scores.

Discussion: Read-write and kinesthetic learners who adopt a deep approach learning strategy perform better academically than do the auditory, visual learners that employ superficial study strategies. Perhaps visual and auditory learners can be encouraged to adopt kinesthetic and read-write styles to enhance their performance in the exams.

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Introduction

Success in teaching involves not only expertise of content material but also an understanding of students' learning styles and study behaviours. Students vary on learning capacities, motivation, styles and approaches. An understanding of these can aid educators to augment teaching strategies to make course work more engaging, meaningful and enjoyable.

Learning style is the way students begin to focus on, process, internalize, and remember new and difficult information.¹ Newble and Entwistle² have reported that improved medical education will require not only substantial changes in teaching, curriculum and, particularly, assessment, but also a new strategy based on identifying and accommodating students' learning styles and approaches. Students' learning styles and approaches to studying may have a significant bearing on their academic success.³

Fleming and Mills⁴ suggested four categories (visual, auditory, reading-writing and kinesthetic - VARK) that seemed to reflect the experiences of their students. The VARK instrument consists of 16 self-report questions that are answered by choosing the best description of a person's preference for situations arising in naturalistic conditions. The scoring profile given at the end of the questions provides the preferred learning style of an individual.

Kumar et al.⁵ have classified medical students according to their predominant styles of learning on visual, auditory, reading-writing and kinesthetic dimensions (VARK). Kumar and Chacko⁶ have reported on the use of appreciative inquiry in creating awareness of individual learning styles of students using the VARK questionnaire. Students reported enhancing the learning environment by an increased knowledge component, enhanced conceptualization of the learning material, increased ability to integrate the material, thus gaining confidence and improved recall of information. There is some evidence for the existence of modality-specific strengths and weaknesses (in visual, auditory, or kinesthetic processing) in people with various types of learning difficulties.^{7,8} Further research is required to investigate the reliability and validity of the VARK questionnaire.

In a similar vein, Biggs developed a theory of learning processes⁹. Surface learning is the tacit acceptance of

information and memorization as isolated and unlinked facts. It leads to superficial retention of material for examinations and does not promote understanding or long-term retention of knowledge and information. In contrast, deep learning involves the critical analysis of new ideas, linking them to already known concepts and principles, and leads to understanding and long-term retention of concepts so that they can be used for problem solving in unfamiliar contexts. Deep learning promotes understanding and application to novel situations as they arise.⁹ Biggs has developed several instruments to assess learning processes including the 20-item Revised Study Process Questionnaire (R-SPQ-2F). This Biggs' revised study process questionnaire assesses superficial or deep approach to learning and has some evidence of validity and reliability.¹⁰

Reid et al.¹¹ have reported that the second year medical course at the University of Edinburgh was changed to promote deep learning, with learning objectives constructed according to the Biggs' structure of the observed learning outcome taxonomy, introduction of learning methods such as problem-based learning and corresponding written assignments and examinations. The Biggs questionnaire classifies students as superficial approach or deep approach learners. Learning styles and learning approach reflect different perspectives. An empirical relationship may provide evidence that students adopting a particular learning style would probably be approaching the learning material either superficially or deeply.

The main purpose of the present study was to further investigate study processes, learning styles, and academic achievement in medical students. Specifically, we wished to 1) investigate study processes (determined by Biggs questionnaire: alone, pairs, groups, combination), 2) assess the learning styles of medical students using the VARK questionnaire, and 3) investigate the relationship between study types, learning styles, learning approaches, and academic achievement.

Methods

Participants

A total of 214 (mean age 22.5 years) first and second year students - preclinical years - at the Asian Institute of Medical Science and Technology (AIMST) University

School of Medicine, in Malaysia participated. There were 119 women (55.6%) and 95 men (44.4%) in the following ethnic groups: Indians (134; 62.6%), Chinese (75; 35.1%), Malay (2; 1.9%), and others (3; 1.4%). The participants who provided complete data were 214 out of 246 students (87.0%).

Setting

AIMST University follows hybrid curriculum consisting of didactic lectures and Problem Based Learning (PBL), and conducts continuous assessment (CA) as formative assessment consisting of exams with multiple choice questions (MCQ's) that constitute 50% of the grades (with no negative markings) while written questions constitute the remaining 50% of the grades. The skill components are assessed by objective structured practical examination (OSPE) and objective structured clinical examination (OSCE) in a clinical skills lab. The continuous assessments are conducted at the end of system/term. For example at the end of cardiovascular system, continuous assessment is conducted. Questions from anatomy, physiology, biochemistry, pharmacology, microbiology, medicine and surgery of the heart and vascular system are included. The examination pattern is the same for all the cohorts.

Instruments

A general questionnaire consisting of the name, age, and sex of the student was administered. The student was also asked whether he/she prefers to study alone, in pairs, or in groups (to determine the study type). The second instrument was the VARK questionnaire.^{5,12} The third instrument was the Biggs questionnaire, which was used to assess the students' learning methods/approaches.¹³ The continuous assessment grades conducted at the end of each system were collected to be used as an indicator of achievement. All the questionnaires were administered as a hard copy. Student questionnaires were scored and tabulated to determine the distribution of learning styles, and study preferences.

This study was reviewed and approved by the Human Investigation Committee of the institutional review board at AIMST University.

Analysis

Descriptive statistics were computed for all the instruments and CA marks, VARK scores and BIGGS

score (deep and superficial approach). The number of observations and percentages were obtained for sex, ethnicity and study process. Statistically significant differences between sex (female and male), ethnicity (Indian, Chinese, Malay and Others) and study process (alone, pair, group, multimodal and combination of all) were determined by Chi-Square Test. Comparison of the mean scores with sex was done by Independent *t*-test and comparison of the mean scores with ethnicity and study types were done by analysis of variance (ANOVA). The correlation between VARK scores with CA marks and VARK scores with BIGGS score were determined by Pearson Correlation and correlation coefficient (*r*). Cross tabulation was done with Cramer's *V* statistics to determine if there is an association between study type with sex and study type with ethnicity.

Results

The number and percentage of participants with study preferences were alone (151; 76.6%), pairs (22; 10.3%), multimodal (19; 8.9%), and combination (22; 10.3%). Cross tabulation results indicated that there was a significant difference in ethnicity (disproportionate number of Indians - 62.6%, $p < 0.001$) and study process ($p < 0.001$). Cross tabulation indicated that for both males and females the most frequent study process was that of studying alone followed by studying in pair, combination and multimodal.

Comparison of mean Continuous Assessment marks and Deep and Superficial approach score with sex, ethnicity and study process showed no significant difference between the subgroups ($p = ns$). There was no significant difference in the other VARK scores and no significant difference between study types and academic achievement ($p = ns$).

There was a significant positive correlation between continuous assessment marks with the Read/Write learner's score ($r = 0.14$, $p < 0.05$), Kinesthetic learner's score ($r = 0.39$, $p < 0.001$) and Deep approach score ($r = 0.76$, $p < 0.001$). There was also a significant positive correlation ($r = 0.72$, $p < 0.001$) between Deep approach score and Kinesthetic learner's score. Those who have obtained higher marks in the continuous assessment have also obtained higher marks in Kinesthetic, Read/Write and deep approach score.

There was a significant negative correlation between Superficial approach score and Continuous Assessment marks ($r = -0.63, p < 0.001$), Read/Write learner's score ($r = -0.17, p < 0.05$), and Kinesthetic learner's score ($r = -0.25, p < 0.001$). Furthermore, comparison between Superficial approach score and Visual learner's score showed a significant positive correlation ($r = 0.16, p < 0.05$). Those who obtained high superficial scores also obtained high visual scores but lower CA marks. There are no significant correlations of assessment marks with the visual and auditory learner. The visual, auditory and read/write learners are not significantly correlated with the deep approach to learning. The kinesthetic learners are significantly correlated negatively with superficial learning.

Discussion

The major purpose of the present study was to investigate the relationships among learning styles, learning approaches, and performance of students. The major findings are 1) the majority of students prefer to study alone, 2) most students employ a superficial study approach, and 3) students with high kinesthetic and read-write scores performed better on examinations and approached the subject by deep approach method compared to students with low scores.

There is a systematic attempt in many medical school curricula, particularly PBL or Clinical Presentations, to promote student group activities and "collaborative" learning. As is evident from the present study, most medical students prefer to study alone or in pairs. Very few students prefer group activities. This is consistent with findings in other medical schools.¹⁴ Similarly, most students employ a superficial study approach even though many medical school curricula (again PBL) have an assumption of a deep study process approach by students. Accordingly, there is a clear mismatch between the assumptions of curricula and the actuality of students' manner and preferences of engagement with the medical school curricula.

In the present study, the students with high kinesthetic and read-write scores performed better in examinations and approached the subject by deep approach method than did their colleagues with low kinesthetic and read-write scores. Medical curricula frequently involve studying human systems and

functions. The knowledge of human anatomy, for example, though frequently presented by lectures (visual and auditory inputs), may best be gained by dissecting the human cadaver (kinesthetic skills in dissection rooms) and writing lecture notes (read-write skills). Similarly learning in physiology may likely be enhanced by measurements of blood pressures, performing ECG recordings, skill lab training in examination of cranial nerves, motor and sensory system and heart sounds and hands on experience.

Kinesthetic learning is multimodal employing a combination of sensory functions. Kinesthetic learners may prefer simulations of real practices and experiences, field trips, exhibits, samples, photographs, case studies, "real-life examples," role-plays, and applications to help them understand principles and advanced concepts of medical education. Read-write learners prefer printed words and texts as a means of information intake; they also prefer lists, glossaries, textbooks, lecture notes, or handouts.¹³ The kinesthetic and read-write students employed a deep approach method of studying and thus perform better in examinations than do the superficial approach learner.

The visual and auditory learners, the superficial approach, learn by passively accepting information in lectures, presentations and so forth. In the present study we have seen that the visual learners employed a superficial approach (employing memorizing and rote) to their courses. They have also performed poorly in the assessments. The auditory learners have shown no significant correlation with their approach and performance in examinations.

Student's performance in continuous assessment was significantly positively correlated with kinesthetic learners and deep approach learners. They also significantly negatively correlated with visual learner and superficial approach learner. When instruction in undergraduate courses matched students' learning style preferences, students achieved higher scores than when mismatched. Similarly, Rochford¹⁵ found that using learning style responsive materials to instruct remedial writing students at an urban community college resulted in significantly higher achievement. Miller¹⁶ also found that both student examination scores and student's attitude toward learning scores were significantly higher when presentations were matched with student learning styles. There are some

limitations of the present study. We had no developmental data on learning styles and approaches though it is possible that they change over time as students move from year 1 to year 5. Additionally, the number of Indian students who also mostly preferred to study independently (alone) were the predominant group (62.62%), the results on ethnicity simply could reflect only this information. Future research should employ more ethnically heterogeneous samples.

Read-write and kinesthetic learners who adopt a deep approach learning strategy perform better academically than do the auditory, visual learners that employ superficial study strategies. Perhaps visual and auditory learners can be encouraged to adopt kinesthetic and read-write styles to enhance their performance in the exams. Meanwhile, we have found that there are relationships between learning styles, study process approaches and academic achievement.

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