



Original Article

Cognitive abilities of health and art college students a pilot study

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Abstract. [Purpose] The selection of a college major is a struggle that high school students undergo every year; however, there is a dearth of studies examining the role of cognitive ability tests as a tool for determining the aptitude of prospective students. Hence, the purpose of this study was to assess cognitive ability differences among students. [Subjects and Methods] A convenience sample of 60 college students (30 health science and 30 art students) with a mean age of 19 ± 1.6 years, voluntarily participated in this study. Cognitive ability was assessed using the self-administered Cognitive Assessment of Minnesota (CAM) scale under the supervision of a researcher. [Results] The findings indicated that there was a significant cognitive ability difference between health science and art students, especially in the cognitive components of knowledge, calculation, and thinking. However, the difference in the social cognitive component of both the health science and art students was not significant. [Conclusion] The results indicate that the health science students' cognitive abilities were better than those of the art students. This finding implies that it is important for high school graduates to undertake a cognitive ability assessment prior to choosing a subject major. Hence, it is recommended that cognitive scales should be included as an aptitude assessment tool for the decision-makers and prospective students to determine an appropriate career, since it might reduce the percentage of university drop-out ratio.

Key words: Cognition, Education, Cognitive Assessment of Minnesota

(This article was submitted Dec. 14, 2015, and was accepted Jan. 20, 2016)

INTRODUCTION

Academic professionals today are faced with classrooms students who come to them with varying levels of individual background. Some are active, self-directed learners who know how to learn and are able to apply what they know in various learning situations. Others may be average students who work hard but don't have an awareness of their learning strengths and weaknesses.

Cognitive abilities have been the focus of behavior investigations for decades, and are defined as processes in the mind that produce thought- and goal-directed action¹⁾. In Physical Therapy (PT), cognitive and physical assessments have been used in clinical practice as a tool to predict or evaluate the functional ability of patients^{2,3)}. Whereas, in Occupational Therapy (OT) cognition is assessed as a component that affects occupational performance in the areas of self-care, productivity, and leisure⁴⁾, and is defined as the ability to function in the tasks, activities, and roles that define the person as an individual⁵⁾. Moreover, it has been observed that individuals with relatively high cognitive levels can perceive more obstacles in the surrounding environment and adopt a better attitude towards the living environment⁶⁾. Hence, a cognitive assessment is considered to be part of the process of assessing clients' roles and performance in occupations.

Self-estimates of cognition play an important role in a person's self-concept as they facilitate an understanding of how

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personal abilities relate to those of others⁷). The assessment of cognitive ability also provides diagnostic information about an individual's self-concept, and this information is potentially relevant for careers such as clinical practitioners, counselors, personnel recruiters, and teachers⁷).

Cognitive abilities are influenced by various factors, which include genetics, environment, and economy. It has been reported that genetic influences affect cognition, and this heritability of cognitive ability increases from childhood to adulthood⁸). Heritability coefficients differ across cognitive abilities as a result of differences in the contribution of genotype-environment covariance, and most heritable abilities are culture-dependent abilities⁹). Economic conditions at birth also play an influence on cognitive functioning later in life in various domains. Economic recessions negatively influence numeracy, verbal fluency, recall abilities, as well as scores on the omnibus cognitive indicator¹⁰).

Several measures have been developed to assess cognitive functioning. Some measures have a greater emphasis on memory and language functioning in analog conditions, and others focus more on functional adaptive skill use. The Cognitive Assessment of Minnesota (CAM) is a standardized assessment of cognitive functioning and has been extensively validated for its internal consistency and good reliability¹¹). Moreover, it has been recommended for use in screening cognitive functioning¹²). The advantage of CAM is that it covers a variety of cognitive skills which are organized into a hierarchy from simple to complex. The maximum total score that can be obtained is 80, and the reported normative value of the US population (ages 18 to 29) is 78.1¹³).

The CAM is frequently used by OTs in clinical practice and in training settings^{14, 15}). However, the psychometric properties of the CAM for college students have not been extensively studied. The purpose of this study was to explore the level of cognitive skills of health science and art college students, based on their CAM scores.

SUBJECTS AND METHODS

A convenience sample of 60 healthy male college students (30 health science and 30 arts college students, aged between 18–24 years, predominantly Asian, who were in their 1st or 2nd year of college participated in this study. Eligible participants completed the Cognitive Assessment of Minnesota (CAM) evaluation form in a university classroom under the supervision of a qualified Occupational Therapist. All the participants were given a detailed description about the test and the objective of this study. The evaluation place of the test was a closed environment to reduce distractions. The time each participant took to complete the test was monitored by a stopwatch, and the average time was calculated. To ensure equality and ethical considerations, this study was approved by the Institutional Review Board, and the study details were explained to the subjects before the CAM survey was conducted with their signed consent.

The CAM is designed to assess a hierarchy of cognitive skills and provide an objective baseline from which to measure cognitive skills such as knowledge, calculation, social, and thinking. In the CAM, each participant is asked about their fund of acquired information or store of knowledge and there are sub-tests (max. score=48), involving manipulation of old knowledge, calculation, and problem-solving as well as further sub-tests concerning (max. score=26), social awareness and judgment (max. score=3), and abstract thinking (max. score=3). The maximum score is 80, and scoring categories range from None – Mild: 52–80; Moderate: 30–51; Severe deficit: 0–29. CAM has inter-rater alpha of 0.90, adequate test-retest reliability, and good concurrent validity with levels of impairment as assessed by an occupational therapist. The CAM has been rated as acceptable for its inter-rater reliability, and it is sensitive to cognitive impairment in traumatic and non-traumatic brain injuries or illnesses, and has 95% specificity in correctly classifying patients with and without cognitive impairment¹³).

Analyses were performed using SPSS 16.0 software for Windows (SPSS, Chicago, IL, USA). The numerical values are presented as the mean \pm SD, except when otherwise specified. Significance was accepted for values of $p \leq 0.05$.

RESULTS

The normative value of CAM scores of all students was 76.5 and their average test time was 21.4 minutes. The mean CAM score of the health science students was 77 ± 1.6 and their average test time was 19.6 ± 2.5 minutes. Whereas, the mean CAM score of the art students was 74.5 ± 2.0 , and their average test time was 22.1 ± 4.3 minute. The paired t-test analysis indicated that there was a significant cognitive ability difference between the health science and art college students, especially in the cognitive components such as knowledge ($p=0.005$), calculation ($p=0.001$), and thinking ($p=0.032$). However, significant difference was not found in the social cognitive component of the health science and art college students ($p=0.326$) (Table 1).

DISCUSSION

The purpose of the present study was to investigate the relative differences of cognitive abilities of health science and art college students, to enhance understanding of the correlation of cognitive abilities with the selection of subject majors by college level students. Moreover, the present results will also help to identify cognitive ability as predictors of academic performance, which is crucial for students seeking post-secondary admission.

The study results show that the cognitive abilities of the health science college students were better than those of the art college students, and that there was a significant correlation between the cognition factor and selection of subject majors.

Table 1. Comparison of the CAM between study groups

Groups (n=30+30)	Knowledge Mean \pm SD	Calculation Mean \pm SD	Social Mean \pm SD	Thinking Mean \pm SD	Total Mean \pm SD	Duration Mean \pm SD
Health Sciences	46.3 \pm 1.1*	24.7 \pm 0.9*	3.0 \pm 0.0†	2.9 \pm 0.3*	77.0 \pm 1.6*	19.6 \pm 2.5*
Arts College	45.5 \pm 1.0	23.5 \pm 1.6	3.0 \pm 0.2	2.7 \pm 0.5	74.5 \pm 2.0	22.1 \pm 4.3

*Between group comparison ($p < 0.05$); and †($p > 0.05$)

This supports the authors' hypothesis that, if the cognitive assessment is a good predictor of academic achievement, then it should yield scores that distinguish between students prior to their academic guidance or choice of subject majors. Despite this correlation, graduate students did not differ in the social aspect of cognition. Our study result is consistent with previous observations that biodata and situational judgment measures can be useful supplements to cognitive indexes of student potential in college admissions¹⁶. This highlights the need to develop measurement tools that are guided by cognitive models of progression towards competence.

It has been reported that there is a narrow range in ability in the case of highly selective post-secondary institutions¹⁷. Knowledge about interpersonal behavior via a video-based situational judgment assessment might be valid for academic and post-academic success of medical students, and especially showed incremental validity over cognitive factors¹⁸. Moreover, the provision by student assessors of feedback that identified problems and gave suggestions was a significant predictor the performance of the assessors themselves, and that positive affective feedback was related to the performance of those assessed¹⁹. Assessments of student knowledge and reasoning patterns play a central role in research on science teaching. At their most effective, assessment instruments provide valid and reliable inferences about students' conceptual progress, thereby facilitating guidance in targeting instruction and evaluating instructional efficacy²⁰. Our study results also suggest the need for examining psychosocial cognitive factors, particularly in the selection of students.

The present study results demonstrate there were cognitive ability differences between health science and art college students, especially in the cognitive components such as knowledge, calculation, and thinking. However, the differences in their social cognitive components were not significant. This might be due to high school grade point averages (GPA) being highly correlated with cognitive performance, since high school GPA is highly correlated with academic performance, as reported by Westrick et al²¹. Traditionally, standardized test scores such as GPA have been the primary criteria used by admission personnel and are thought to accurately predict college of choice. However, there is an increasing use of psychosocial factors as additional sources of valid data for predicting academic performance²². High school GPA is considered cognitive assessment tool of academic performance. Students with higher high school GPA have the psychosocial skills for college success. Academic discipline mediates the relationship between high school GPA and college GPA²³. A cognitive assessment of student thinking is crucial because it explains varying levels of performance and thus guides assessment design and interpretation. Valid assessment methods, in turn, are a set of specifications for assessment tasks that elicit illuminating responses from students. Such scales allow students to meaningfully express their scientific understanding and reasoning processes. Moreover, valid inferences about student thinking and understanding can be gained from assessment scores using quantitative methods designed to detect varying levels of student competency²⁰. It has been reported that greater handgrip strength is also associated with higher cognitive function²⁴. Our results also emphasize the importance of the role of cognitive assessment in admissions, and that the CAM correlates better with broad measures of academic achievement, such as physical and cognitive items, which were used in the recruitment of all the study subjects by the Health Science College and Arts College. Identifying the best predictors of academic performance, especially between two subject majors such as health science and arts, is extremely important for academic success. Therefore, being able to identify accurate selection criteria that predict student success and persistence is crucial for the survival of educational organizations¹⁶.

The present results also allow students to participate in simulated novel tasks related to real-life academic demands. Cognitive assessment is used to identify areas of individual and environmental difficulties and to enable student-centered goal setting with the participation of both students and their parents. The cognitive assessment can be used to recruit prospective students and also to explain how it can help admission counselors; specifically, how the student's interests, skills, and abilities will be matched with the values, roles, and opportunities of the college environment. Information gathered during cognitive assessment can be utilized by therapists to better assist their clients in actual day to day activities that require the same skills.

Cognitive abilities may be impacted by many variables other than individuals' utilization of GPA skills. These confounding factors may be physical illness, variations in personal motivation, and potential problems with the technology required for the academic assessment. Demographic factors and traditional measures of cognitive capacity or prior academic performance might arise due to personality traits, motivational factors, self-regulatory learning strategies, students' approaches to learning, and psychosocial contextual influences²⁵. These factors may also confound the relation between cognitive abilities and the choice of subject major.

In a longitudinal study, it was observed that first-generation students are at a significant disadvantage across cognitive and psychosocial outcomes compared to students whose parents have at least some post-secondary education²⁶. Moreover, socioeconomic status (SES) is considered to be a weak predictor of both academic performance and retention.

The positive correlation between the CAM and subject majors emphasizes cognitive scales as a tool for professors to use to screen students in need of direct instruction. This may become especially important in large student populations as well as in online assessment where professors do not have an opportunity to get to know their students on an individual basis.

The mode of classroom teaching and student's attention differences between health science and arts also affect cognitive function. Self-regulated students are less likely to text during class and are more likely to sustain their attention in classroom learning, which, in turn, facilitates cognitive learning²⁷). The findings also provide good support for the use of the social cognitive career theory (SCCT) framework to identify predictors of science, technology, engineering, and mathematics (STEM) self-efficacy and to design academic retention services and career development interventions for college students²⁸).

Our study group subjects included only male students because of the previous observation that gender differences do not lead to corresponding differences in cognitive assessment and academic performance levels²⁹). However, recent studies have reported that gender differences should be considered in physical activity and social cognitive theory factors³⁰). Hence, gender differences should be considered in future CAM.

It is concluded that the health science students' cognitive abilities were better than those of the art students. The results of the present study suggest the importance of cognitive ability assessment of high school students prior to their choice of a subject major. Hence, it is recommended that cognitive scales should be included as an aptitude assessment tool for decision makers and prospective students to determine an appropriate career since it might reduce the university drop-out ratio.

ACKNOWLEDGEMENT

The authors would like to extend their appreciation to the Deanship of Research, Research Center, College of Applied Medical Sciences at King Saud University for constructive scientific support during this research.

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