

Assessment of mental workload and academic motivation in medical students

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Abstract

Objectives: To investigate the level of correlation and direction of linearity between academic motivation and subjective workload.

Method: The study was conducted at Baskent University School of Medicine, Ankara, Turkey, from December 2013 to February 2014, and comprised Phase 5 Phase 6 medical students. Subjective workload level was determined by using National Aeronautics and Space Administration Task Load Index scale that was adapted to Turkish. Academic motivation values were obtained with the help of Academic Motivation Scale university form. SPSS 17 was used for statistical analysis.

Results: Of the total 105 subjects, 65(62%) students were in Phase 5 and 40(38%) were in Phase 6. Of the Phase 5 students, 18(27.7%) were boys and 47(72.3%) were girls, while of the Phase 6 students, 16(40%) were boys and 24(60%) were girls. There were significant differences in Phase 5 and Phase 6 students for mental effort ($p=0.00$) and physical effort ($p=0.00$). The highest correlation in Phase 5 was between mental effort and intrinsic motivation ($r=0.343$). For Phase 6, highest correlation was between effort and amotivation ($r= -0.375$).

Conclusion: Subjective workload affected academic motivation in medical students.

Keywords: Mental workload, Academic motivation, Medical education. (JPMA 66: 574; 2016)

Introduction

Motivation problems have considerable impact on academic performance. Motivation is defined as "an intrinsic motive which triggers behaviours of the individual, influences and maintains the continuity of these behaviours, reflects the sentiments and expectations of the individual".¹ Yet extrinsic motives such as rewarding, applause, physical and social factors also affect motivation. Academic motivation (AM) is a concept where factors and effects of motivation are discussed from point of view of education. A number of factors like expectations of students, attitude of instructors, physical educational conditions, personal characteristics and social facilities of the educational institution have impact on this concept.

Mental workload (MWL) factor as perceived by the student has a great deal of importance on AM. MWL directly influences the performance, reaction, attention, stress and fatigue levels of the student. Workload is defined as the amount of work at a certain working pace and in a certain degree of quality.² Workload is a phenomenon which emerges under the effect of work requirements (physical, mental, time constraints, work pace etc.), working conditions, capabilities, habits and

perceptions of the individual.

The current study was planned to see whether there were differences between MWL and AM scales or not in medical students.

Subjects and Methods

The study was conducted at Baskent University School of Medicine, Ankara, Turkey, from December 2013 to February 2014, and comprised Phase 5 Phase 6 medical students. After getting approval from the institutional review board, AM values were obtained with the help of Academic Motivation Scale (AMS)-university form. It was first developed in 1992 by Vallerand et al. for the purpose of measuring students' level of motivation in education.³ Maurer et al. examined the effect of AM on the success level in human anatomy and physiology classes.⁴ They proved that high-level inner motivation positively affected studying habits, endeavour, studying time and overall success of the students. Singh et al. compared the motivation levels of students between distance education system and conventional education system.⁵

AMS is based on Deci and Ryan's Self Determination Theory.⁶ According to this theory, individual's behaviours are manipulated by three fundamental needs, which are the need of autonomy (the ability of making a choice on issues concerning the individual), the need of self-sufficiency (using and improving one's capabilities) and the need of interpersonal relations enabling the individual to be with other people and have the sense of self-esteem.⁷

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According to the theory, individuals will effectively work and salubriously progress as their needs are satisfied. In cases where these needs are not satisfied they will tend to fall apart and display unintended behaviours. Self-determination theory examines AM in three different dimensions; intrinsic motivation (intrinsic motivation to know, intrinsic motivation to accomplish, intrinsic motivation to experience stimulation), extrinsic motivation (extrinsic motivation identified regulation, extrinsic motivation introjected regulation, extrinsic motivation based on external regulation) and amotivation.^{3,7} In case of intrinsic motivation, internal factors like curiosity for learning and satisfaction of success influence the student, whereas in extrinsic motivation the student makes efforts for learning to earn applause from other individuals, to avert their criticism and to be rewarded.^{7,8} Amotivation is the state of being not motivated intrinsically or extrinsically. As a result, students cannot perceive the relation between their own activities and their results, and face a situation in which they feel incapacitated which they cannot control.³ A student with a high AM level thinks positively about school, finds school satisfactory, acts persistently in hard tasks, causes few administrative problems and deeply processes information.

AMS-university form consists of 28 questions and has seven-level likert scale, containing questions that measure intrinsic motivation, extrinsic motivation and amotivation. Seven different dimensions throughly examining motivation are evaluated. The values of each of these dimensions are calculated by addition of ratings obtained from four different questions. Ratings of dimensions are minimum 4 and maximum 28. This scale was translated to Turkish and its validity and reliability analyses were carried out by Karagüven.⁹

Some of the methods used to measure MWL in literature are Subjective Workload Assessment Technique (SWORD), National Aeronautics and Space Administration (NASA) Bipolar Index, Hart and Hausert Rating Scale, Crew Status Survey, NASA Task Load Index (TLX) etc.¹⁰⁻¹³ The most prevalent one and the one which is applicable to maximum number of different fields of work is the NASA TLX method. NASA TLX was first developed by Hart and Staveland.¹⁴ Stefanidis et al. analysed the MWL level created due to utilisation of laparoscopic surgical simulator and figured out the effect of such utilisation on surgical success of students.¹⁵ Relation between the MWL and task complexity degrees of fast train conductors were studied by Park et al.¹⁶ Stefanidis et al. considered the MWL occurrence due to usage of robotics support in practising intracorporeal sutures in laparoscopic

treatments.¹⁷ Mazur et al. measured the MWL emerging during radiation therapy planning task of doctors.¹⁸

NASA TLX, which is designed to measure the MWL, is a multi-dimensional grading method.¹⁹ It considers the physical effort, mental effort, time pressure, performance, effort levels and sense of frustration. Physical effort dimension questions how much physical activity is needed while accomplishing a task. Mental effort determines the mental and perceptual effort spent during the task. In time pressure, the important issue is how much pressure is sensed from the point of view of task accomplishment pace. In performance level, achievement level in fulfilling a task is determined. In effort dimension, intensity of physical and mental activities needed to reach the current performance level is investigated. In sense of frustration, degrees of 'feeling insecure', 'exhausted', 'nervous', 'stressed' and 'angry' are considered.¹⁴ Workloads for each of the dimensions are obtained through a grading analysis in 0-1 interval. The scale comprises two parts. In the first part, the participant is asked to score each dimension between 0-100 considering the work being done. The second part is composed of dual comparisons meant to measure the dominance of dimensions over each other. The participant makes 15 comparisons for six different dimensions. As the number of choices for a dimension increases, its contribution to overall workload also increases.²⁰ Taking into account these comparisons for an individual, with the help of the scores obtained in the first part, workloads for all dimensions are separately calculated. The overall workload is found via summation of dimension MWLs. The overall workload attains a value between 0 and 100.

SPSS 17 was used for statistical purposes. Conformity of parameters to normal distribution was verified by Kolmogorov Smirnov Test and homogeneity of group variances was checked by Levenetest. In independent groups, t test was applied to parameters satisfying preconditions of parametric tests, and Mann-Whitney U test was applied in other groups. $P < 0.05$ was accepted as statistically significant. Identifying statistics was presented in the form of mean \pm standard deviation (SD). In correlation measurements, Pearson Correlation was utilised when data conformed with normal distribution while Spearman Correlation Test was implemented otherwise. Results of reliability analysis were given with Cronbach's Alpha Value.

Results

Of the 130 students approached, 105(80.7%) subjects volunteered to take part in the study. Of them, 65(62%)

Table-1: Examination of AMS and NASA TLX results in terms of phases.

AMS	PHASE 5 Mean±SD (n=65)	PHASE 6 Mean±SD (n=40)	p-value
Intrinsic motivation to know	21.46±4.89	21.65±4.69	0.846
Intrinsic motivation to accomplish	15.26±5.01	15.78±5.71	0.630
Intrinsic motivation to experience stimulation	16.43±5.07	16.35±5.42	0.939
Extrinsic motivation identified regulation	22.58±4.18	22.28±3.55	0.698
Extrinsic motivation introjected regulation	13.58±4.96	13.35±3.83	0.799
Extrinsic motivation based on external regulation	20.11±5.27	20.60±5.00	0.636
Amotivation	8.02±5.29	6.23±2.62	0.415
NASA TLX			
Mental effort	19.56±6.91	8.31±9.58	<0.0001*
Physical effort	7.23±7.24	19.36±10.34	<0.0001*
Time pressure	13.69±8.35	12.12±9.20	0.371
Performance	12.39±8.58	11.61±8.75	0.652
Effort	14.92±7.99	13.83±6.50	0.469
Frustration	8.01±9.26	8.99±9.33	0.461
Overall workload	75.81±12.21	74.23±14.64	0.843

SD, Standard deviation

*p<0.0001, statistically significant

AMS: Academic Motivation Scale.

NASA TLX: National Aeronautics and Space Administration Task Load Index scale.

Table-2: Examination of the results of three dimensions that belong to AMS in terms of phases.

AMS (Three main dimensions)	PHASE 5 Mean±SD (n=65)	PHASE 6 Mean±SD (n=40)	p-value
Intrinsic motivation	17.72±4.29	17.92±4.89	0.821
Extrinsic motivation	18.76±3.98	18.74±3.09	0.979
Amotivation	8.02±5.29	6.23±2.62	0.415

SD, Standard deviation

AMS: Academic Motivation Scale.

students were in Phase 5 and 40(38%) in Phase 6. Of the Phase 5 students, 18(27.7%) were boys and 47(72.3%) were girls, while of the Phase 6 students, 16(40%) were boys and 24(60%) were girls.

Cronbach's alpha value for AMS reliability was 0.8603 for Phase 5 and 0.8958 for Phase 6 students which made it sufficiently reliable. In AMS analysis, the dimension having the highest average was identified as the extrinsic motivation in Phase 5 (22.58±4.18) and Phase 6 (22.28±3.55) students. Amotivation had the lowest average value in Phase 5 (8.02±5.29) and Phase 6 students (6.23±2.62). No significant difference was obtained between the averages of the seven different dimensions between the two sets of students (p>0.05 each) (Table-1).

In NASA TLX analysis, the difference between averages of

two phases in terms of mental effort (19.56±6.91 in phase 5; 8.31±9.58 in Phase 6) and physical effort (7.23±7.24 in Phase 5; 19.36±10.34 in Phase 6) was significant (p<0.0001, p<0.0001). The highest average value was mental effort (19.56±6.91) in Phase 5 and Physical effort (19.36±10.34) in Phase 6 students. Physical effort had the lowest average value (7.23±7.24) in Phase 5, and mental effort (8.31±9.58) in Phase 6. Frustration (8.01±9.26 in Phase 5; 8.99±9.33 in Phase 6) for both phases had comparatively lower averages with respect to other dimensions.

Seven different dimensions of AMS were reduced to three main dimensions and it was observed that in both phases extrinsic motivation (18.76±3.98 in Phase 5; 18.74±3.09 in Phase 6) had the highest and amotivation (8.02±5.29 in Phase 5; 6.23±2.62 in Phase 6) had the lowest average value. No statistical difference was found between the student groups in terms of the three main dimensions (Table-2).

In Phase 5, negative correlation was determined between performance and amotivation, and between extrinsic motivation and frustration (r=-0.337; r=-0.284). However, intrinsic motivation was positively correlated with mental effort, and amotivation was positively correlated with frustration (r=0.343; r=0.339). In Phase 5, the highest correlation was between intrinsic motivation and mental effort (r=0.343). Correlations between other MWL

Table-3: Correlations (r) between NASA TLX and AMS values.

NASA TLX AMS	PHASE 5			PHASE 6		
	Intrinsic motivation	Extrinsic motivation	Amotivation	Intrinsic motivation	Extrinsic motivation	Amotivation
Mental effort	0.343**					
Physical effort						
Time pressure						-0.320*
Performance			-0.337**			
Effort						-0.375*
Frustration		-0.284*	0.339**	-0.332*		0.334*
Overall workload						

*p<0.05

**p<0.0001

AMS: Academic Motivation Scale.

NASA TLX: National Aeronautics and Space Administration Task Load Index scale.

dimensions and AM dimensions were not statistically significant (p>0.05).

In Phase 6, amotivation was negatively correlated with time pressure and effort (r=-0.320; r=-0.975). Moreover, correlation between intrinsic motivation and frustration was negative (r=-0.332), whereas the correlation between amotivation and frustration was positive (r=0.334) (Table-3).

Discussion

To the best of our knowledge, the study is the first one to examine the correlation between AM and MWL. Also, there has not been a study investigating differences between study levels in terms of both the concepts.

AM is an important factor to affect the attitude and behaviour of the individual during the entire education period. Observations revealed a higher level of mental workload perception in Phase 5 compared to Phase 6, as a more intense theoretical education is given in this period. During this period lectures and watches are carried out simultaneously and internship transition process is experienced by the students. A higher level of physical workload was recorded in Phase 6 students compared to Phase 5 students as a result of decreasing theoretical education, while they are supposed to do rotations between different medical branches and experience direct doctor-patient relationships. Both Phase 5 and Phase 6 students perceive equal workloads in performance (P), effort (E), time pressure (TP) and frustration (F) dimensions.

In Phase 5, correlation between mental effort (ME) and intrinsic motivation (IM) which enables high-quality learning and creativity, was in accordance with workload results. During this phase, students keep on getting theoretical education, feel enthusiastic about passing on

to internship and gain experience in watch duties. In Phase 5, as motivation increases, performance decreases. Loss of motivation in students would inevitably lead to loss of productivity and success. Thus motivation directly affects student performance. A student who feels unsuccessful would experience a decrease in extrinsic motivation (EM) as he/she would foresee less possibilities or having professional advantages. As for Phase 6, an increase in F resulted in an IM downfall, and this adversely affects students' enthusiasm and pleasure for commencing their profession. These students being at the closest point to becoming a general practitioner have a more professional perspective and more difficulty in coming to terms with failure. At the same time, in case of failure their enthusiasm and pleasure for medical profession declines. Apparently for both phases, students with low motivation levels would feel themselves unsuccessful. As for every individual, motivation and determination brings along success.

In Phase 6, a student who is deprived of motivation would feel no appetite for learning and activity and, hence, would not experience a temporal anxiety. Reduction in motivation is also accompanied by diminishing desire for effort. Correlation between escalation in F and escalation of amotivation (AMT) was in accordance with this result. Students who lose enthusiasm embark on a journey of professional loss and struggle to reach their goals. This would lead them to evading their responsibilities.

In the current study attention was drawn to MWL and AM. To the best of our knowledge, this is the first study showing the above-mentioned relationship in medical students. The NASA TLX scale was developed for military pilots at first than it has been applied in psychology, computer systems, transportation and health

professions.^{21,22} Like pilots, medical students do their duties in very stressful and technologically-advanced environments. But there is a difference between pilots and medical students in the context of periodic evaluations of MWL. MWL is routinely assessed for pilots, but is not periodically assessed for medical students. This routine evaluation may be helpful to develop and adopt education policies. In this way, students' MWL can be decreased and education system can be implemented efficiently and AM can be increased.

We found that some of the concepts examined were correlated with others. It is obvious that MWL has a significant impact on the dimensions of AM for the individual. Our findings provide scientific evidence for the anticipated interactions among the examined factors driven from real life.

We could not detect any difference between Phase 5 and Phase 6 medical students with respect to AM which might be due to the closeness of the phases. Therefore, we plan to compare individuals from different phases such as; Phase 4 vs. Phase 6 medical students; Phase 6 medical students vs. Residents; and Medical Fellows vs junior and senior medical doctors, as well.

Conclusion

Subjective workload affected academic motivation in medical students. More studies are recommended to explore the phenomenon further.

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