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MOTIVATION TO LEARN IN SECONDARY SCHOOL PHYSICS

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Abstract
The aim of this study was to adapt the Science Motivation Questionnaire developed by Glynn and Koballa (2006) into Albanian context as Physics Motivation Questionnaire and report validity and reliability of the study. The sample was 110 secondary school students from four private high schools in Albania. The data collected was analyzed and compared with the original questionnaire. Similar factor loadings were found. Based on the principal component analysis six dimensions which were intrinsically motivated physics learning, extrinsically motivated physics learning, confidence in learning physics, relevance of learning physics to personal goals, anxiety about physics assessment, and self-determination for learning physics were found out. The Cronbach's alpha reliability was found to be 0.805. This questionnaire aims to measure secondary school students' motivation to learn physics.

Key Words: *Physics, Secondary School Science, Newton's Laws of Motion, Motivation, Education, Science.*

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1. INTRODUCTION AND LITERATURE REVIEW

Max Tegmark (2015) said "Physics is the ultimate intellectual adventure, the quest to understand the deepest mysteries of our Universe. Physics doesn't take something fascinating and make it boring. Rather, it helps us see more clearly, adding to the beauty and wonder of the world around us." As motivation has positive effect on students' achievement the basic goal of science teaching should be making students feeling in this way (Singh, Granville, & Dika, 2002).

According to Zusho, Pintrich, and Coppola (2003), motivation can be defined as "the process whereby goal-directed activity is instigated and sustained". Motivation has effects on initiation or duration of behaviors. The studies on motivation report that the students learning outcomes are positively correlated to their motivation to learn (Glynn & Koballa Jr, 2005; Gutwill-Wise, 2001; King & Ritchie, 2013; Parchmann et al., 2006; Ramsden, 1997; Tytler, 2007). For that reason, curriculum developers and teachers should consider the importance of motivation to learn.

Studies in the literature also reported that students are more intrinsically motivated when teachers increase students' interests and relevance in a motivationally designed course (Ryan & Deci, 2000; Singh et al., 2002) . Additionally, these studies suggest active learning environments for students in order to increase their motivation, and motivational tools to be developed.

A questionnaire can be used as a tool to measure students' motivation to learn physics. In order to evaluate students' motivation to learn science the Science Motivation Questionnaire was developed by Glynn and Koballa Jr (2005). As there as so less studies and tools to measure students motivation this study aims to adapt the Science Motivation Questionnaire (SMQ) into Albanian context as Physics Motivation Questionnaire (PQM).

2. RATIONALE OF THE STUDY

Constructing a motivational environment in class is important for meaningful physics learning although it is challenging to do so. It is becoming more important to evaluate students' physics motivation if we take the constructive effect of motivation on learning physics as well as students' achievement in physics. Taking this fact to the

focus of the study it is needed to explore the motivation and its factors. Later on some activities to promote students' motivation can be developed. For this reason, assessing students' motivation to learn physics takes an important role and; therefore, the main purpose of the study was to translate and validate the Science Motivation Questionnaire to the Albanian cultural context as Physics Motivation Questionnaire and to identify the factorial structure.

Learning, according to social cognitive theory, described with students' characteristics, behaviors and interaction with their learning environments. An individual contributes his/her future with developing abilities according to aims (Bandura, 1991). There are six factors of motivation to learn regarding to self-regulated learning, these are: 1) intrinsic motivation, 2) extrinsic motivation, 3) goal orientation, 4) Self-determination; 5) Self-efficacy, 6) assessment anxiety (Bandura, 1991; Koballa & Glynn, 2007).

Science Motivation Questionnaire developed under six factors. (Glynn & Koballa Jr, 2005; Glynn, Taasoobshirazi, & Brickman, 2009; Koballa & Glynn, 2007). These are can be listed as;

1. Intrinsic motivation: Intrinsic motivation leads students to learn.
2. Extrinsic motivation: Extrinsic motivation is tool to achieve the goal which will be obtained after learning. A student may be both intrinsically and extrinsically motivated while working on a project which he/she likes while expecting a price at the end.
3. Personal relevance: Personal relevance can be related to learning goals or performance goals.
4. Self-determination: Self-determination implies the preference and control of the students over learning.
5. Self-efficacy: Self efficacy is the confidence of students about their abilities.
6. Assessment anxiety: Every student may have some sort of anxiety where moderate level of anxiety may contribute positively to learning while high levels of anxiety may affect motivation to learn negatively.

Physics motivation Questionnaire (PQM), the adopted version of SQM, consists of 30 items and six factors. PMQ is prepared as 5 Point Likert Scale. The items are scored as

1 (never) to 5 (always). The PMQ aims to assess high school students' motivation to learn physics.

3. RESEARCH QUESTION AND METHODOLOGY

Research question of this study were as follows:

Is Physics Motivation Questionnaire (PMQ) reliable to use into Albanian culture to assess high school students' motivation to learn physics?

3.1 Instrument

The Physics Motivation Questionnaire (the Science Motivation Questionnaire and the adopted Physics Motivation Questionnaires are given in the appendix) is a 5 point Likert scale which has 30 items. Students can give responses from never to always, including "rarely", "sometimes", and "usually", in between. The factors of the scale are intrinsically motivated physics learning, extrinsically motivated physics learning, relevance of learning physics to personal goals, responsibility for learning physics, confidence in learning physics, and anxiety about physics assessment, which are labeled as intrinsic, extrinsic, relevance, self-determination, responsibility, self-efficacy, confidence, and anxiety respectively (Çetin-Dindar & Geban, 2010) The Cronbach's alpha reliability coefficient, which explains the percentage of total variance, was found as 0.93 and it can be stated that at least 93% of the total score variance is due to true score variance.

3.2Translation

The translation of the Science Motivation Questionnaire was carried out by researchers in the proper fields taking the validity concerns in to account. The Albanian translation of the SQM was made by bilingual researchers independently. Later on each translation were matched and compared for possible inconsistencies. Two independent bilingual researchers reverse translated the Albanian translation of the SQM in to English. The back translated version and the original SQM are compared for haziness in the items. This was done also to assure the theoretical and ethnic similarity of the questionnaire. After the evaluation of the translated Albanian version it is tested with 14 11th grade pupils. The responses are evaluated by researchers to make revisions to prepare final

version of the Physics Motivation Questionnaire. The final version of the PMQ was given to 110 11th grade students.

3.3 Sample

The sample selected for the study was 110 11th grade students from four different private high schools in Albania. The study was included 55 female students and 54 male students, one student did not state gender. The PMQ lasted 15 minutes and administered during students' physics courses.

4. DATA ANALYSIS

The data collected from students analyzed via SPSS 21.0 for Windows. Students' responses were recorded with respect to their responses. Always recorded as "5" and never recorded as "1" while usually, sometimes and rarely were recorded as "4", "3" and "2" respectively. There were some items of the component "the anxiety about physics assessment" which were reversely coded. Thus these items of the component were recoded inversely (i.e. the response "always" recorded as "1"). The minimum score that a student can take from PMQ was 30 and the maximum score was 30.

The reliability of the PMQ was analyzed by internal consistency which is assessed via Cronbach's alpha. Fraenkel and Wallen (2003, p. 168) advises the Cronbach's alpha to be at least 0.70 for educational studies.

5-CONCLUSION: ANALYSIS AND FINDINGS OF THE STUDY

Considering the meaning the of items the components were labeled as intrinsically motivated physics learning (6 items), anxiety about physics assessment (4 items), confidence in physics learning (6 items), relevance for learning physics to personal goal (5 items), extrinsically motivated physics learning (6 items), and responsibility for learning physics (3 items), respectfully (for factor loadings for each component see Table - 1).

The PMQ items were subjected to principal component analysis (PCA) the Kaiser-Meyer-Olkin value was 0.783, expressing the suitability of data for factor analysis, exceed the recommended value of 0.5 (Field, 2000, p. 456). Additionally, Barlett's Test of Sphericity reach statistical significance supporting the factorability of the correlation

matrix (χ^2= 1344.755, df = 435, 0,000). The PCA revealed six components exceeding eigen-values, which were 7.955, 3.004, 2.422, 1.792, 1.489, and 1.234, respectively (Table -2).

The reliability coefficient for the full questionnaire estimated by Cronbach's alpha was 0.805, indicating high internal consistency and the Spearman-Brown reliability coefficient was found to be 0.653.

The six factors explained a total of 59.653% of the variance, with component intrinsic contributing 26.517%, component extrinsic contributing 10.013%, component confidence contributing 8.073%, component relevance contributing 5.975%, component anxiety contributing 4.962%, and component responsibility contributing 4.112% (Table - 2).

The interpretation of the questionnaire was consistent with previous research on the SMQ with six components, which are theoretically and statistically justified (Glynn & Koballa Jr, 2005; Koballa & Glynn, 2007). These components are intrinsically motivated physics learning, anxiety about physics assessment, confidence in learning physics, relevance of learning physics to personal goals, extrinsically motivated physics learning, and responsibility for learning physics. The Cronbach's alpha (α=0.805) and Spearman-Brown reliability (r= 0.653) for the full motivation physics questionnaire was acceptable (recommended Cronbach's alpha value should be greater than 0.70). The Albanian version of the PMQ's internal consistency (α=0.805) is just a bit smaller than the English version of the questionnaire's internal consistency (α=0.93). Based on these findings, it can be interpreted that the adaptation of this questionnaire is successful because of showing satisfactory reliability and validity results and is appropriate to use PMQ in the Albanian culture to assess students' motivation to learn physics. Additionally, the similar versions of this questionnaire can be adapted to the other disciplines like chemistry, mathematics, or biology as well as other languages.

Motivation studies are reporting gender issues in motivation to learn science (Britner & Pajares, 2001; Debacker & Nelson, 2000; Meece & Jones, 1996; Pintrich & Schunk, 2002, as cited in Çetin-Dindar, & Geban, 2010). According to Çetin-Dindar and Geban (2010) there is no statistically significant differences on overall motivation scores but in terms of anxiety about physics assessment and extrinsically motivated physics learning scores of girls and boys are different from each other. This questionnaire can

also be used to measure the differences in motivation to learn between girls and boys in Albanian context.

Vallerand (2002) mentions that Students can be either, for sure, intrinsically motivated or extrinsically motivated because both motivations can exist within students at different levels so physics teaching should involve activities both intrinsically and extrinsically motivated (as cited in Çetin-Dindar, & Geban, 2010).

Table 1: Factor loadings for each component

	Component					
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Mot01	**,808**					
Mot30	**,790**		-,300			-,370
Mot16	**,789**				,378	
Mot02	**,722**			,370		
Mot22	**,649**	-,315		,346		
Mot03		**,607**	-,473	,375		
Mot12		**,510**				
Mot07		**,761**				
Mot17		**,711**				
Mot14		**,646**		-,473		
Mot15	-,331	**,635**				
Mot29			**,755**			
Mot24			**,749**		,320	
Mot21			**,719**			
Mot26			**,660**			-,323
Mot28		-,419	**,622**	,433	,337	
Mot19			**,578**	,461	,340	,337
Mot06	,522			**,790**		
Mot18	,411		-,304	**,764**		
Mot13				**,746**	,317	
Mot04	,307	,345		**,380**		
Mot23		,377			**,719**	
Mot10		-,502	-,413	,304	**,652**	
Mot11	,355			,499	**,504**	-,309
Mot27					**,422**	-,352
Mot25					**,763**	
Mot20			-,310			**,737**
Mot05	-,411			,409		**,687**
Mot08			-,366	,425		**-,605**
Mot09	,405			,374		**-,478**

Table 2: Factor analysis scores for each component

		Eigen Values	Variance explained
Components	Intrinsic	7.955	26.517%
	Extrinsic	3.004	10.013%
	Confidence	2.422	8.073%
	Relevance	1.792	5.975%
	Anxiety	1.489	4.962%
	Responsibility	1.234	4.112%
Total variance explained			59.653%
Cronbach's alpha			0.805

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