Validity of Single-Item Self-Report Measure of Examination Stress

Paulina Łukowicz, Anna Choynowska, Anna Maria Świątkowska,
Piotr Bereznowski, Wiktor Kornel Wróbel,
Paweł Andrzej Atroszko

University of Gdańsk

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Łukowicz Paulina, Choynowska Anna, Świątkowska Anna Maria, Bereznowski Piotr, Wróbel Wiktor Kornel, Atroszko Paweł Andrzej

Institute of Psychology, Faculty of Social Sciences, University of Gdańsk

Paulina Łukowicz: paulina.lukowicz@gmail.com

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Abstract

Interest in the examination stress among children and university students, often referred to as test anxiety, has been constantly growing since 1950s. This phenomenon has quickly become subject of many theories, which spawned various tools to measure it. Moreover, research on examination stress is often conducted on large samples with multiple measurements in different time periods and multiplicity of other traits measured at the same time. Hence, valid, reliable, and short tools, which would significantly reduce time needed to fulfil questionnaire and fatigue of participants, are especially desired. The aim of the present study was to provide support for the validity of the single-item, self-report measure of examination stress. The study was conducted among 235 students from University of Gdańsk, 197 females (83.8%), 35 men (14.9%) and three persons who did not state gender (1.3%). Participants were from different faculties, courses of study, years and modes of study. Mean age was 20.46 years ($SD = 1.37$). The obtained data provided initial support for the construct validity of the measure. Existing studies indicate that the application of single-item scale can be a promising alternative for a multi-item and multidimensional scales in situations, where quick and easy measurement of examination stress is needed.

1. Introduction

The number of tertiary students in Europe in 2013 was close to 20 million (Statistical Office of the European Communities 2015). Each one of them has to face numerous exams during single semester, and most of them also had to face exams and tests during the whole period of previous education. According to Denscombe (2000), any formalized assessment performed among young students can be described as the fateful moment of their lives. This fact indicates that students at all levels of education can be exposed to a recurring stress which can influence their health and behavior (Lantz et al. 2005; Lupien et al. 2009). Basing on Hudd and colleagues' study (2000), stressed students not only perceive their health status as less satisfying, but also tend to have lower self-esteem. These findings suggest that it is vital to systematically study *examination stress* on large and preferably representative samples of students to understand its major determinants and consequences. In order to achieve this aim, it is essential to develop accurate, valid and reliable measures of examination stress, which would be convenient to use in large survey settings. Previous studies showed that single-item scale of examination stress can be valid and reliable (Atroszko 2013; Atroszko 2014; Atroszko 2015). The aim of this paper is to present further data on the validity of a single-item measure of examination stress.

Examination stress can be defined as uneasiness experienced by students both prior to, and during assessment situation (Putwain et al. 2010). The core factors of examination stress are fear of failure, fear of negative evaluation from others and threat to esteem or social position (Putwain 2009).

Although term *test anxiety* is used in literature more than examination stress, often they are used interchangeably. Psychological stress occurs when one believes that environmental demands exceed their adaptive capabilities (S Cohen et al. 1995). It manifests itself through negative affective state and physiological arousal (S Cohen et al. 2007). On the other hand, anxiety is a state when one experiences arousal, yet is not certain or fully aware of the source of threat (Spielberger 2013). The Authors of this article will use the term examination stress for the studied phenomenon, because considering its nature, this term seems more appropriate, although when citing other articles original nomenclature is preserved.

Test anxiety became a subject of research in the 1950s. Since then the topic has been widely investigated, and many theories and definitions regarding this concept have been formed. One of the most popular theories was developed by Alpert and Haber (1960) who proposed a bidimensional model that divided test anxiety into *debilitating* and *facilitating*. The former one is task-irrelevant, the latter, task-directed. Debilitating test anxiety was found to consist of two components: *worry*—a cognitive concern about one's performance, and *emotionality*—autonomic reaction of the organism. However, another, more recent, notion that is based on previous theories says that exam stress is, in fact, a multidimensional construct which consists of three components—behavioural, cognitive, and affective (Zeidner & Mathews 2005). Another theory explaining the functioning of highly test-anxious students is the *deficit model*, according to which high exam stress is a result of deficient knowledge of the material due to ineffective study habits and awareness of inadequacy (Birenbaum & Pinku 1997).

Examination stress appears when students believe that the evaluative situation exceeds their intellectual, social, or motivational capabilities, which may evoke negative self-beliefs and counterproductive coping (Putwain et al. 2010). Three sources of pressure can be observed: parents, teachers, and students themselves. Parents evoked pressure appears when students believe that their acceptance is based on academic achievements which leads to poor academic self-concept (Putwain 2009) and is strictly related to the newly developed concept of study addiction (Atroszko 2015; Atroszko, Andreassen et al., 2015, 2016a, 2016b). On the other hand, parental support reduces examination stress through increasing competence beliefs (Putwain et al. 2010). Teachers' behaviours such as constant reminding of deadlines and of the need to revise, or emphasizing how important test results are in students' future life, as well as expecting high grades also evoke examination stress. Students feel motivated only if expected grade is perceived to be within their ability range, and when it seems to be unrealistic and unachievable it is perceived as source of pressure (Putwain 2009). What is more, females (Chapell et al. 2005; Hong & Karstersson 2002), highly neurotic (Komarraju & Karau 2005) and externally oriented students (Carden et al. 2004) experience higher examination stress. Perception of lower competence and poor academic self-concept, as well as study addiction predict higher examination stress as well (Atroszko 2015; Zeidner 1998).

What is more, students who experience high examination stress often engage in task-irrelevant behaviours (Putwain 2010) and are more likely to get distracted during work (Keogh et al. 2004). They perform poorly on tests (Cassady & Jahnson 2002; M Cohen et al. 2008), receive worse grades (Chapell et al. 2005), are less sociable (Hembree 1988), and experience higher general anxiety (Hong & Karstersson 2002). Moreover, such students have lower sense of well-being, less self-control and self-acceptance, are not willing to accept responsibilities, have lower intellectual efficiency, and problems with retrieving information during assessments (Hembree 1988). Gregor (2005) claimed that optimal, not minimal, level of examination stress enhances performance the most. It goes along with Yerkes-Dodson Law, which says that the relation of arousal and task performance is curvilinear and when graphically depicted forms a shape of inverted U, meaning that too little and too much arousal reduces performance, but optimal level of it enhances performance to the maximum (RA Cohen 2011). This is related to the differentiation of stress into eustress—the optimal, most motivating level of arousal, and distress—"bad", debilitating stress (Golińska et al. in press). This distinction can be observed in relation to examination stress.

According to diagnostic criteria of American Psychiatric Association (2013) patients experiencing depression episodes suffer from loss of motivation, impaired concentration, disturbed sleep, and fatigue. It is estimated that 3.0% to 16.9% people (depending on country they live in) experience at least one episode of depression during lifetime (Andrade et al. 2003). Since depression can be described on continuous scale (Guo et al. 2014; Ruscio & Ruscio 2000; Slade & Andrews 2005), in present study this variable is understood as *depressiveness*. Studies showed that being depressed causes difficulties in different areas of learning and school or academic work (Fröjd et al. 2008; Hysenbegasi et al. 2005). Depression often co-occurs with other mental problems, especially with anxiety disorder, but also with substance use disorder and impulse control disorder (Kessler et al. 2003). They are closely related, and even after excluding overlapping symptoms, depression and anxiety are still positively related to each other (Anderson & Hope 2008). Moreover, studies showed,

that depressiveness, measured by Behavior Assessment System for Children – Self-Report of Personality (which describes children's and adolescents' perceptions and feelings about school, home, peers, and their own behavior) is connected to debilitating anxiety (Lowe et al. 2008). Considering these facts, examination stress can be positively related to depressiveness.

Sleep is one of the basic biological needs, which is necessary for maintaining proper bodily functions. Studies show that people with sleep insufficiency are more likely to suffer from a variety of physical and mental health problems (Strine & Chapman 2005). Sleeping disorders can also have impact on students' school successes (Gaultney 2010). Lack of sleep causes anxiety, influences mood and lowers social competences (Wolfson & Carskadon 1998). Since lack of sleep is connected to anxiety, it is not surprising that self-reported sleep disturbance is positively related to test anxiety (Blankstein et al. 1990). In the mentioned study test-anxious students turned out to be more likely to be frequently awakened during sleep and they claimed that they obtained not enough sleep. After awakening they were relatively more likely to say that they "woke up with many worries", "woke up in very bad mood", and "woke up extremely tired". Therefore, it can be assumed that the time spent on sleeping will be negatively related to test anxiety.

Learning engagement is a part of bigger construct, which is school engagement. School engagement as a multidimensional phenomenon can be defined in many ways (Appleton et al. 2008). According to Audas and Willms (2001) this kind of engagement can be described as extent to which young people identify with their school and derive a sense of well-being from their academic work. This study focuses on engagement which is associated with process of learning, not with school as an institution, so consequently it is called learning engagement (Łukowicz et al. in press). Nevertheless, both constructs have common factors, which include devoting time to learning and attending classes (Appleton et al. 2008; Łukowicz et al. in press) and because of that, they can be treated as akin. Studies show that school engagement is associated with better grades (Carini et al. 2006; Li & Lerner 2011) and that students with stable engagement over time are less likely to dropout from school (Archambault et al. 2009; Janosz et al. 2008). On the other hand, being overly engaged in learning may turn into study addiction (Atroszko, Andreassen et al. 2015), and when controlling for learning engagement, study addiction is negatively connected to Grade Point Average (Atroszko 2015; Atroszko, Andreassen et al. 2015). Previous study showed that test anxiety may influence students' grades (Chapell et al. 2005). According to Caraway et al. (2003) study, test anxiety has a negative association with grades, but there is no significant relationship between test anxiety and school engagement (assessed by Rochester Assesment Package for Students). Likewise, the same study showed that there is no relationship between test anxiety and school attendance. In light of these findings it can be assumed that there is no relationship between examination stress and learning engagement.

Being present at every lecture and additionally studying outside of university classes requires a lot of determination. Spending less time on learning than needed has a direct negative effect on achievements (Gettinger 1984). Previous studies showed that high test-anxious students rate their study skills and habits less positively than low-anxious individuals (Cassady 2004). The same study revealed that high test-anxious students perceive course examination as more threatening than low-anxious students. These high-anxious students see approaching threat, but in their own opinion, they do not have necessary skills to overcome it. Because of that, students can fall into procrastination (Cassady & Johnson 2002) or develop avoiding strategies (McGregor & Elliot 2002; Putwain 2010). These findings may indicate that examination stress will be negatively related to time devoted to learning, both at the university classes and outside of them.

Although multidimensional measures are very useful in a comprehensive assessment of individuals, they lack in terms of ease of administration. On the contrary, ultra-brief measures are highly practical as carrying out research becomes quicker and the potential drawbacks of using long instruments, such as fatigue of the participants, are minimized. Furthermore, single-item scales prove to be valid and reliable tools in many research contexts, and previously were used in the academic context to measure psychosocial functioning (Atroszko, Bagińska et al. 2015; Atroszko, Krzyżaniak et al 2015; Atroszko, Pianka et al. 2015) and personality (Atroszko, Sawicki, Sendal et al. 2017). Recent study provided preliminary data on convergent validity of a single-item and multi-item

measure of satisfaction with life, including almost identical pattern of correlations of the two measures with criterion variables (Atroszko, Sawicki, Mąkinia et al. 2017). Examination stress is often described as a multidimensional construct, nevertheless, these dimensions are strongly related to each other (Everson et al. 1991). Thus, person's score on one dimension allows fairly accurate prediction of person's score on all other dimensions. Therefore, usage of single-item scale to measure learning engagement seems justified in specific survey situations and the present study aims to provide data on the validity of such tool.

On the basis of previous research and theoretical frameworks it is hypothesized that: examination stress is positively related to depressiveness (H1) and negatively to sleeping time (H2); examination stress is negatively related to time spent on learning outside of university classes and at the university, however, it is not related to learning engagement (H3).

2. Methods

Participants. The research was conducted among 235 students, including 197 females (83.8%), 35 males (14.9%), three students did not provide information on their gender (1.3%). Students were between 18 and 26 years old, mean age was $M = 20.46$ years ($SD = 1.37$). Twelve persons were excluded from analyses because they did not answer to questions regarding learning engagement, so correlation analysis was conducted on 223 students, 187 females (83.9%), 35 males (15.7%) and one person did not provide information on their gender (0.4%). Mean age was $M = 20.48$ years ($SD = 1.38$). Participants were from different faculties, courses of study, years and modes of study, all of them were students of University of Gdańsk. This sample was included in the analysis presented in previous paper (Łukowicz et al. in press) therefore, data on learning engagement cannot be interpreted as new independent information.

Measures. Examination stress was measured using single-item self-report measure which asked the question "How stressed are you usually during exams which you take as a part of your studies?" (Atroszko 2014). Responses ranged from 1 (*I am not at all stressed*) to 7 (*I am completely stressed*). It showed good validity and test-retest reliability (intraclass correlation coefficient was .78) in previous research (Atroszko 2014; Wróbel et al. 2016).

Learning engagement was measured using single-item self-report measure which asked the question "How engaged in learning are you?" (Atroszko 2014). Responses ranged from 1 (*I am not at all engaged*) to 7 (*I am completely engaged*). It showed good validity and test-retest reliability (intraclass correlation coefficient was .77) in previous research (Atroszko 2013; Atroszko 2014; Atroszko, Andreassen et al. 2015).

Depressiveness was measured with Beck Depression Inventory (BDI-IA; Beck & Steer 1993). It is a tool widely used for diagnosing depressive disorders in adults and adolescents. It consists of 21 multiple choice questions regarding symptoms of depression experienced in the past month. To each question there are four alternative responses, valued from 0 to 3 points, varying in level of depression diagnosticity. Questionnaire showed good validity and reliability in previous studies (Ambrosini et al. 1991; Atroszko 2015). In the present sample, the Cronbach's alpha reliability coefficient was .90.

To measure time spent on learning outside of university classes and at the university students were asked to estimate mean number of hours spent weekly on each activity. To measure the amount of time spent on sleeping individuals were asked to estimate mean number of hours spent daily on sleeping. All measures showed good validity and test-retest reliability in the previous research (Atroszko 2015).

Procedure. Data collection used convenience sampling and was performed from February to April 2012. Students were invited to participate anonymously in the study during lectures or classes. Over 90% agreed to fill in *paper and pencil* questionnaire. No monetary or other material rewards were offered for participation.

Statistical analyses. Means, standard deviations, percentages, and correlation coefficients were calculated. All statistical analyses were conducted with IBM SPSS 24.

3. Results

Examination stress ($M = 4.95$, $SD = 1.56$) was positively related to depressiveness ($r = .15$, $p = .030$), learning engagement ($r = .18$, $p = .006$), and time spent on learning at the university ($r = .17$, $p = .012$). Negative association was observed between examination stress and gender of participants ($r = -.24$, $p < .001$), showing that females score higher on examination stress. Relationships between examination stress and time spent on learning outside of university classes, time spent on sleeping, and age of participants were not statistically significant. Mean scores, standard deviations, and percentages for the study variables, as well as their relationships with examination stress are presented in Tab.1. Full correlation matrix is available from the first author after request.

4. Discussion

Hypothesis 1 was confirmed. The results of the study showed that examination stress was positively related to depressiveness. Previous studies showed that more depressive people are also more neurotic (Fanous et al. 2002) and generally show higher levels of anxiety and stress, which predisposes them to experiencing higher examination stress.

Tab. 1. Mean scores, standard deviations, and percentages of study variables as well as their correlation coefficients with examination stress.

Variable	M/%	SD	Examination stress
1. Gender[a]	15.7% males		$-.24$***
2. Age	20.48	1.38	$-.11$
3. Depressiveness	31.82	9.13	.15*
4. Time spent on sleeping	7.16	1.70	$-.05$
5. Learning engagement	4.49	1.34	.18**
6. Time spent on learning outside university classes	13.81	12.48	.06
7. Time spent on learning at a university	17.96	8.20	.17*

[a] Point-biserial correlation coefficient (0 = females, 1 = males).
*$p < .05$. **$p < .01$. ***$p < .001$.

Hypothesis 2 was not confirmed. Examination stress was not related to time spent on sleeping. Simple measure of hours spent on sleeping may not capture the complex nature of sleep related both to natural time needed for sleeping and the quality of sleep. The effect of sleep deprivation on test anxiety may be more subtle and complex. Future studies should take this into account.

Hypothesis 3 was not confirmed. The results showed that examination stress was positively related to the time spent on learning at the university and learning engagement, and not related to learning time outside the university classes. By definition, one of the core components of learning engagement is time devoted to learning (Appleton et al. 2008). People who are highly engaged in learning put more effort into it, and spend more time on learning, therefore they are more concerned with outcomes of the tests and their grades in general. These results may be explained by a newly developed construct of study addiction (Atroszko, Andreassen et al. 2015) which is defined as negative overinvolvement into studying to the exclusion of other spheres of life, leading to negative consequences for psychosocial functioning. While learning engagement and study addiction share common characteristic of high investment of time and energy into learning, the former is a positive phenomenon while the latter is a negative one. This result may indicate pending need for controlling for study addiction in all research related to learning engagement.

The obtained data provide further support for the construct validity of the single-item measure of examination stress. One of the main strengths of this research is that it was carried out on students, a group who is to the highest extent exposed to stress resulting from exams. The problem is particularly significant due to the negative impact of stress on both physical (Watson & Pennebaker 1989) and mental health (Hudd et al. 2000). Strengths of this study include applied valid and reliable measures of criterion variables and sample of students was large enough, yielding sufficient power of statistical analyses. Using single-item scales significantly reduces time needed to fulfil questionnaires,

therefore minimizes potential drawbacks of using long instruments such as fatigue of the participants. In terms of limitations, the sample was predominantly female, and not representative. Consequently, the results cannot be generalized to the population of students in Poland without some restrictions. Furthermore, all data in the present study were self-reported which increases the risk of common method bias. Future research should overcome these limitations as well as focus on obtaining and analysing further data on the psychometric properties of a single-item scale in various populations. Moreover, complex relationships between such constructs as learning engagement, examination stress and academic and psychosocial functioning draw attention to the need for controlling study addiction in all educational research settings.

5. Literature

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