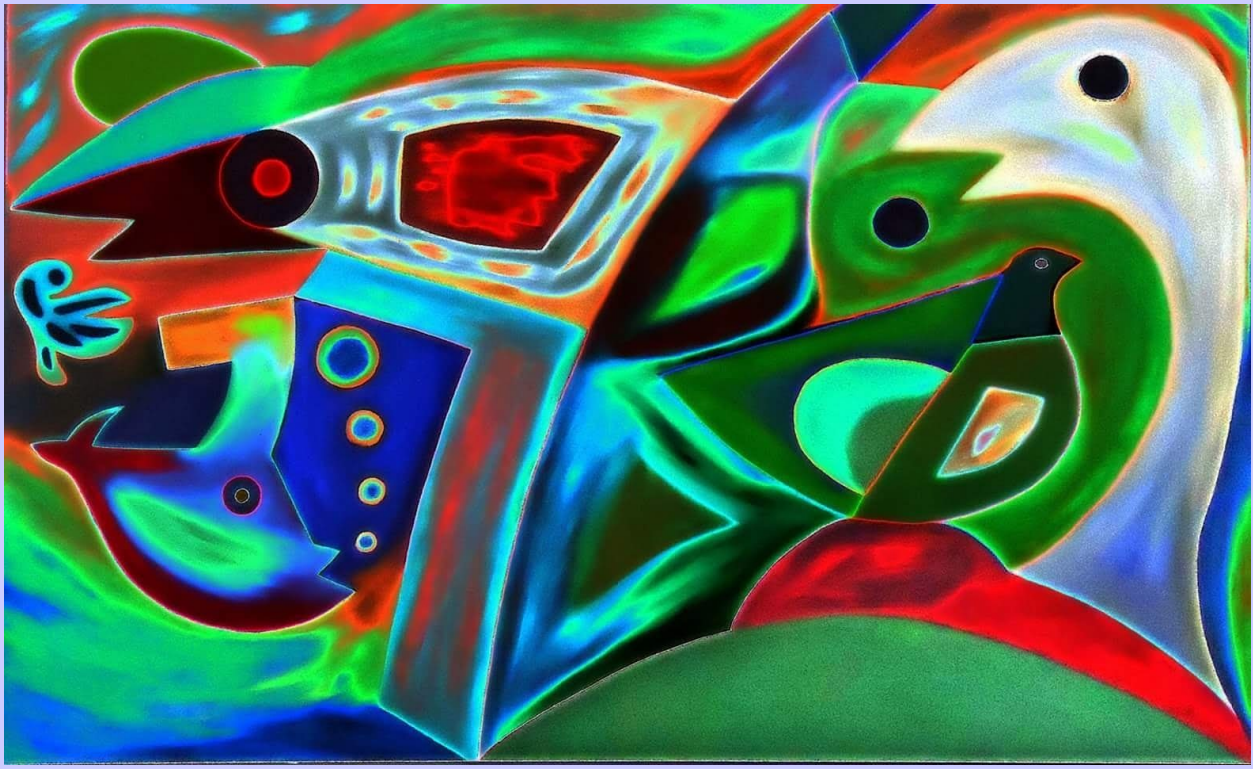
Journal of Digital Art & Humanities



ISSN 2712-8148

Vol.3 Iss.2 **December 2022**

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The relationship of students' psychological security level in the digital educational environment

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https://doi.org/10.33847/2712-8148.3.2_3

Received 27.09.2022/ Revised 17.11.2022/Accepted 23.12.2022/Published 27.12.2022

Abstract. Currently some studies that demonstrate the correlation between students' level of psychological security and their academic performance and engagement have been published. Many studies have examined the importance of the level of psychological safety among students, some of which have proposed a methodology for assessing this indicator. To assess students' level of psychological security in studying, there were conducted online surveys. The sample included 351 students between the ages of 19 and 21 (M = 19.57, SD = 0.59), predominantly female (57%). As a result of the survey, it was found that women showed a higher level of psychological safety. The same trend was found in levels of academic engagement and academic performance. Using linear regression analysis, psychological safety was found to positively affect academic performance and attainment, especially in an online educational environment.

Keywords: Psychological Security, Behavioral Engagement, Cognitive Engagement, Emotional Engagement, Academic Performance.

1. Introduction

Due to COVID-19 and its consequences, almost all universities in the world were transferred to distance learning, including Peter the Great St. Petersburg Polytechnic University (SPbPU). Before COVID-19 only 4% of all university courses were online, 14% were partly online and 82% were full-time, so changes had to be made urgently [1, 2]. The full transition to learning in a digital environment has caused many difficulties in various fields of education. According to Buzzetto-More and Koohang [3], affected areas are the psychological state of students and teachers, students' engagement, and an equally important point is academic performance. Many researchers have studied various indicators that may directly and indirectly influence students' attitude towards educational process, their academic involvement and performance [4]. The main task of the university in the transition to distance learning was to create a secure and comfortable digital environment for students, so that students feel psychologically safe. It was also important to keep the students' interest and desire to continue their studies and actively participate in the learning process. Many researchers studied the importance of psychological security level among students, some of them proposed the methodology of assessing the indicator [5]. Nevertheless, there are few studies that demonstrate the relationship between psychological security level of students and their academic engagement and performance.

This study addresses a valuable contribution to the Russian literature by comprehensively assessing psychological security level of students and their academic engagement and performance, investigating whether psychological security mediates the relationships between academic engagement and performance, considering the university students perceptions. The following research questions are presented in order to address the need to generate actions to set an effective educational environment:

1. How do students' varying degree of psychological security relate to their behavioral, emotional, and cognitive engagement?

2. How do students' varying degree of psychological security relate to their academic performance?

2. To what extent does the level of psychological security predict students' academic performance and engagement?

Therefore, this study pursues as main goals to: a) determine the relationships between the levels of psychological security and the sex of a sample of university students; b) establish the associations between psychological security level, academic engagement and performance.

1.1 Theoretical Background

E-learning, which is considered a new approach of learning, covers all the ways of learning and teaching supported by technology [6], and includes all definitions related to increased accessibility of sources, flexibility towards the learner, and extension of abilities [7]. In addition, it is considered the fastest and least costly way, making it affordable for everyone to participate in the learning process. L. G. Nazarova [8] argues that Dynamic eLearning covers innovative information accessible to all learners. The concept of e-learning offers educational organizations using this technology a number of benefits, incorporating short and efficient learning curve, flexibility and modularity. Weaknesses of e-learning are high dropout rates, high design and maintenance costs [9].

Several studies have been conducted on student and user perception of e-learning. Buzzetto-More & Koohang [3] conducted a study of student perceptions of various components of e-learning. They discovered that e-learning can improve students' understanding of the course content they are taking, and this will have an influence on higher education. Selim [10] showed that students perceive teacher characteristics as the most important factor in the success of e-learning. Mohd Alwi [11], who studied the perception of e-learning specialists, uncovered that their respondents agree that there are security risks in e-learning, and good safety supervision in e-learning is significant to ensure a secure e-learning environment.

It should be noted that modern educational institutions strive to use e-learning in order to be skilled to satisfy all requests, among which psychological safety is of paramount importance.

Psychological security. Security is acquiring the newest strategic and socio-economic role, including to guarantee the consistent functioning of any organization that aims to protect the environment and sustainable progress in existing conditions. Security is a major part of human needs; therefore, it is important to recognize its important role in education and training. [12].

Students are the largest users of e-learning. Students are disturbed about their privacy and safety when using the e-learning system. They are concerned that sensitive information, such as their ratings and what they do, might be disclosed to others. They also need a reliable system so they don't get frustrated when using a system that could affect their academic performance. It is important to consider the needs and opinions of students as the largest users of the e-learning system in order to ensure the successful implementation of the system in any educational institution. One of the reasons people reject the online system has to do with computer security concerns. Availability, integrity and confidentiality are the building blocks of computer security [3].

Psychological safety as a mental feeling of acceptance, love, receiving help and as an emotionally oriented system has been considered by some authors as something that contributes to the satisfaction of emotional requirements, satisfaction and a sense of belonging. [13] (pp. 5-12). This leads to harmony with society, detection

and recognition of realities and adaptation to them, the disclosure of inner talents and, finally, the promotion of a healthy lifestyle among societies [14] (pp. 71-81).

Online users using the system fear that they will lose their privacy, the privacy of their personal information, and the availability of the system when they need it. In an e-learning system, users will feel more confident in interacting and collaborating with others when mechanisms are in place to ensure confidentiality, trust, and a secure environment. Students' perception of the service quality of the e-learning system is important as students can offer insights into the conditions that reduce the quality of service in e-learning and they experience the institution's service delivery system day after day [15].

Students' engagement. A significant assessment for teaching students in a digital environment is engagement. Fredricks and McColsky [16] noted that while some researchers explain it in terms of views and principles about the significance of learning, others define it as an effort beyond the bare minimum.

Based on an analysis of digital learning publications Halverson et al. [17] discovered that about half of their publications mention the term "engagement". Their outcomes also presented that, despite the common usage of the term, in very exceptional cases, research is directly linked to involvement in digital learning.

Several scientists have proposed a multidimensional interaction model [18-20]. According to this theoretical model, engagement is multidimensional, which can embrace behavioral, emotional and cognitive aspects [21, 22]. According to Fredicks et al. [19], behavioral engagement underlines involvement, stubbornness, and participation in academic activities. Emotional engagement centers on positive and negative reactions to peers, professors, and institutes, as well as evaluating learning results. In terms of cognitive collaboration, it comprises the student's involvement to the understanding of the topic. "Cognitive engagement draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills" [19] (p. 73).

Academic engagement expects numerous long-standing positive effects such as pursuit of higher education, steadiness in learning modes, enhanced job prospects, positive self-perception and welfare, and less depressive indications [23-27]. Thus, participation can have positive and wide-ranging results even outside the educational environment. In addition, academic participation was discovered to be strongly associated with academic inspiration and performance: students rate their studies, score higher, and report lower levels of academic abstinence and effort avoidance [28].

Log records from electronic learning management systems can keep independent and related data, such as how many times a student has logged in. Although scholars have concentrated on log files for various points, they infrequently used these log archives for analysis interactions. It is only lately that Gobert, Baker, and Wixon [29] have established procedures to notice engagement in the online study environment for examining scientific questions. Hence, other methodologies, such as interviews, have their benefits. Scientists can use interview techniques to get comprehensive material about why students partake or do not partake in certain events, why students vary in communication performance and contextual aspects that can lead to student engagement or disengagement [30]. Taking into account the point that each method to dimension has its pros and cons, a number of academics recommend using numerous techniques to measure engagement [31-33].

Thus, it seems possible for us to analyze the mutual influence of student engagement on their academic performance. However, during the pandemic, given the fact that education is completely digitalized, a new dimension emerges that affects both student engagement and academic performance. Unfortunately, no relevant studies on this topic have been found. In the current study we would like to share the experience and to fill the existing research gap using a mixed methods approach to

take into account all factors: students' psychological security level, students' engagement and learning outcomes in a digital environment.

2 Materials and Methods

2.1 Participants and Procedures

The study involved university undergraduate students (2nd year of study) of Peter the Great Saint-Petersburg Polytechnic university aged from 19 to 21 years (M = 19.57, SD = 0.59), 57% females. The total number of participants in the sample was 351. A survey of students was conducted online using the Moodle platform. Consent was obtained by all participants in this study. The results were collected at the end of the spring semester 2020 after 4 months of distant learning due to COVID19 situation. Analyses were carried out on the depersonalized data.

2.2 Measures

For the assessment of students' psychological security in online educational environment, the Trustworthiness Factors survey was used [1]. It includes 10 statements that explore interpersonal trust in work groups identifying trust-building behaviors ranked in order of importance, and it is divided into two categories: Trustworthiness Building Factors (TBF) (e.g., "I communicate honestly, without distorting any information") and Trustworthiness Reducing Factors (TRF) (e.g. "I make excuses or blame others when things do not work out").

The Trustworthiness Factors survey was previously validated in a sample of 16–18 years old students (N = 102). The validation study showed that coefficients of internal consistency of items for each scale ranged from 0.51 to 0.75, indicating an overall reasonable homogeneity of the items in each scale. Each statement is rated on a 5-point Likert scale.

The present study measured students' Academic Engagement Scale using the three most common dimensions identified by researchers, which included behavioral, emotional, and cognitive engagement. We measured behavioral engagement through students' attendance records of online lectures in MS Teams and records of online logins to the Moodle platform (results are presented in 10-points scale). To identify emotional involvement, we used Motivation Questionnaire. Special statements were created to identify the students' perceptions about teaching and learning offered, defining five indicators: desire of learning after university, anxiety, positive attitude to learning, self-esteem, and self-demand. For each of the questions, the participants marked one of the five Likert-scale responses. The questionnaire included two questions for each motivation factor. To investigate students' cognitive engagement we conducted a survey consisted of three items defining cognitive criteria, which index the extent to which students are attending to and expending mental effort in the learning tasks encountered ("I put a lot of effort into preparing for classes on Moodle"; "I was engaged with the topics at hand in lectures"; "I invest much time in implementing homework tasks"). The Cronbach's internal reliability coefficient obtained in our study for the Academic Engagement Scale was 0.84.

We used the students' semester grades in professional disciplines as measures of academic performance. Russian universities assess students' performance using a 4-point system, with grade 5 indicating excellent performance, 4—good performance, 3—satisfactory performance, 2—not satisfactory (fail).

We analyzed data using IBM SPSS Statistics, version 21: ANOVA, correlation and regression analyses.

3 Results

3.1 Descriptive Statistics and Gender Differences

The descriptive statistics for all variables are presented in Table 1.

Table 9. Means, standard deviations and ANOVA results by gender

Measures		ALL (N=351)		Females (N=200)		Males (N=151)		ANOVA effects
		M	SD	M	SD	M	SD	
Trustworthiness Factors Scale	Trustworthiness Building Factors	3,83	0,71	3,87	0,74	3,78	0,69	0,58
	Trustworthiness Reducing Factors (R*)	3,24	0,68	3,11	0,68	3,35	0,66	0,23
Academic Engagement Scale	Behavioral engagement	8,3	0,91	8,71	0,87	7,62	1,12	0,005
	Emotional engagement	4,17	0,76	4,31	0,72	4,02	0,97	0,38
	Cognitive engagement	3,93	0,81	4,01	0,77	3,69	1,14	0,03
Academic Performance	Students' average semester grade on professional disciplines	3,86	0,68	4,09	0,71	3,67	0,66	0,01

*Reversed results

The obtained results reflect that girls have significantly higher indicators of the Academic Engagement Scale compared to boys. This fact is consistent with earlier data, for instance, Guay, Vallerand, Blanchard [34] y Ayub [35]. There were no significant gender differences in Trustworthiness Factors, however, boys show higher rates of Trustworthiness Building Factors, while the indicator of Trustworthiness Reducing Factors was lower by boys.

3.2 Correlation analysis

Also, we conducted a Pearson correlation analysis to identify whether TFS scores impact the academic engagement scores of the students. The results are shown in Table 2.

Table 10. Pearson's correlation results for the variables under study (N = 351).

	1	2	3	4	5	6
1.Trustworthiness Building Factors	1					
2.Trustworthiness Reducing Factors (Reversed)	0.61***	1				
3.Behavioral engagement	0.31**	0.19	1			
4.Emotional engagement	0.25*	0.22*	0.34**	1		
5.Cognitive engagement	0.28**	0.24*	0.17	0.13	1	
6.Academic Performance	0.17	0.15	0.21*	0.19	0.25*	1

Note: * p<0,05; ** p<0,01; ***p<0,001

When Table 2 is examined, it is seen that the TFS scores and the academic engagement scores of the students have a significant and positive correlation. At the same time the Trustworthiness Building Factors and Trustworthiness Reducing Factors both had a quite weak influence on students' academic performance (R=0.17; R=0.15).

3.3 Regression analysis

The results of the linear regression analyses conducted to analyze whether the psychological security level of the university students predicted the academic engagement are presented in Table 3.

Table 11. Trustworthiness Factors Scale scores as a predictor of academic engagement

	B	SEB	β	t	F	R2	Adjusted R2
Constant	2.71	.10	.35	7.89**	48.29**	0.14	0.16
TFS	.01	.00		6.87**			

Dependent variable: Academic engagement, **p< 0.001

According to Table 3 the TFS scores predict the academic achievement levels of the students significantly in a positive way (β= 0.35, t = 6.87, p < 0.001). 4% of the total variance of the academic engagement scores can be explained by the SDI scores (R2 = 0.144, adjusted R2 = 0.141).

The results of the linear regression analyses conducted to analyze whether the psychological security level of the university students predicted the academic engagement are presented in Table 4.

Table 12. Trustworthiness Factors Scale scores as a predictor of academic performance

	B	SEB	β	t	F	R2	Adjusted R2
Constant	2.09	.09	.15	2.78*	7.73*	0.023	0.027
TFS	.01	.00		3.14*			

Dependent variable: Academic performance, *p< 0.01

In Table 4 it is shown that the TFS scores predict the academic achievement levels of the students less significantly than academic engagement scores but also in a positive way (β= 0.15, t = 2.78, p < 0.01).

These findings show that feeling of the psychological security is an enhancing effect on the academic engagement and academic performance levels of the students.

4 Discussion

The rapid transition of the educational process to the digital environment has caused excitement among both teachers and students. Students' anxiety stems not only from novelty, but also from a disturbed sense of security. In our study, we examined the impact of psychological safety of students on academic performance and student engagement in the educational process.

For the analysis we used the Trustworthiness Factors survey, students' attendance records of online lectures in MS Teams and records of online logins to the Moodle platform, Motivation Questionnaire and cognitive criteria survey. Also, we analyzed students' semester grades in professional disciplines as measures of academic performance.

In contrast to earlier studies [3, 10, 14], we consider student safety not only as an aspect of personal data security, but more as a psychological one. We confirm that the psychological security of students affects the behavior of students during the educational process, namely, the activity of their participation in the classroom, enthusiasm for the process, the feeling of comfort and the effectiveness of learning in a digital environment. The direction of our research is similar to the works of Rafie, Ramid and Hashini [13] and Miguel Moneo et al. [4].

Researches [30-33] on students' engagement assessment allowed us to choose the best methods for analyzing this factor. However, unlike all previous studies, our study focuses on the relationship between the psychological safety of students and their willingness to take an active part in the educational process.

The present study allowed us to highlight the important role that the psychological security plays in the online learning, considering the perceptions of the studied university students. The focus on the relationship between trustworthiness factors that are reflected the level of psychological security, academic performance and engagement constitutes an added value of this paper, since most of the international research has focused mainly on the methodology of assessing the psychological security and defining the borders of its definition. It was possible to conclude that the influence of psychological security on students' engagement and academic performance is particularly visible in the online educational environment. This is an important result that should be consequently considered extremely valuable, influencing the design of online learning and technologies to improve the students' perceptions of psychological security in the Russian university context.

4.1 Limitations of the Present Study and Suggestions for Future Research

It should be noted that our study has limitations. Only students from Russia were analyzed, therefore, these students had a similar mentality, which can differ from representatives of other countries and affect the psychological security state. Also, the study was conducted on a short time frame basis since distance learning was introduced in March 2019, which is a short period. Furthermore, the transition to the distance format was made very abruptly, literally in a week the educational process completely switched to a digital environment. Such drastic changes could negatively affect the psychological state of students and affect the results. Thus, with a smoother transition with advance preparation of students, the results may differ.

We hope that our research will be useful for future scientific work. This direction is promising, since distance education continues at the present time. It is important to study separately the adaptability of students to the digital environment over time, the selection of educational technologies specifically for the digital environment, in order to improve the academic performance of students and their sense of security. In addition, it seems important to study aspects of the psychological health of teachers, as participants in the educational process.

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Aims and Objectives

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