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ONLINE TEST ANXIETY AND EXAM PERFORMANCE OF INTERNATIONAL BACCALAUREATE DIPLOMA PROGRAMME STUDENTS UNDER E-PROCTORED EXAMS AMID COVID-19

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Abstract

Outbreak of COVID-19, online examination, and e-proctoring have caused more exam anxiety and affected exam performance among students' studying in International Baccalaureate (IB) Diploma Programme (DP). Therefore, the present research aimed to find effect of online test anxiety on academic performance of IBDP students in the subjects related to science, technology, engineering, and mathematics (STEM). Study employed quantitative descriptive survey research design and administered survey questionnaire to 200 IB DP students who took online test during COVID-19 through convenient sampling technique. Sample included both first and final year DP students with due representation to boys and girls. Results of the study revealed a moderate negative correlation between online test anxiety and academic performance of IBDP students in STEM subjects. Regression analysis explained 14.1% variation in the STEM subject performance because of online exam anxiety under e-proctored condition. There exists a statistically significant difference between first and final year students' online exam anxiety and STEM subject average grades. Future research may focus on conducting comfortable online examination methods with no additional exam anxieties.

Keywords: *International Baccalaureate (IB), Diploma Programme (DP), e-proctored test, virtual examination*

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Introduction

Ever since the Covid-19 pandemic broke out, countries across the globe started to impose various restrictions in order to curb the infection rates (Gonzalez et al., 2020). Institutions around the world were faced with closures with an estimated 1.6 billion students from 180 countries ceasing to attend schools (Panovska-Griffiths et al., 2020). During such a catastrophic and unexpected scenario many institutions resorted towards rejuvenating the education system via the online mode of instruction (Crawford et al., 2020). Teachers proceeded towards conducting classroom lectures online (Abidah et al., 2020). The pandemic gave opportunities for digitally immersed education. Conferences, examination, lectures, and student-teacher interactions are now occurring virtually (Kumar, 2020; Strielkowski, 2020). The concept of Online learning or e-learning is not relatively new and is historically originated as an alternative for students who could not attend face-to-face teaching-learning (Wedemeyer CA, 1981). However, this started to gain significant recognition over the past decades with numerous studies and research exploring online learning (Daffin Jr. & Jones, 2018; Marshall, 2008; Roddy et al., 2017).

Assessment is a vital component of teaching-learning, it is often considered by students as a measure of their success for their academic performance (Boud, 1990) but the restrictions imposed due to lockdowns posed a major challenge for assessment (OECD, 2020). Initially, countries were compelled to postpone the examinations for the higher education (Butler-henderson & Crawford, 2020) but due to the increase in infectivity rates globally, institutions resorted towards online testing via 'e-proctoring' in order to assess students. Monitoring students over the internet through electronic tools remotely for examinations or test refers to 'Virtual proctoring or e-proctoring' (Pathak, 2016). This mode of online assessment is deemed to be effective and reduces mal-practice (Dendir & Maxwell, 2020). This mode of proctoring usually monitors the candidate audio and video feed obtained from their gadgets (Webcam, microphone) and their progress on the computer by mirroring their screens. E-proctoring software prevents the candidate from opening other tabs or apps in the background (Caballero-González & García-Valcárcel, 2020). Online proctoring is of two types: automated or live proctoring. In live proctoring, the students are monitored in real time by a particular assigned proctor remotely. Software flags any unusual physical activity or eye movements or nearby phone, indicating mal-practice. In automated proctoring, the proctor is not constantly monitoring the students, rather any forms of suspicious activity indicating mal-practice are recorded and reviewed later (Hussein et al., 2020; Raman et al., 2021). Both these types are applicable for assessments, but live proctoring can be suggested as a better option due to constant monitoring which prevents any imposter taking the test on the candidate behalf (Nie et al., 2020). Even though tests like the GMAT, LSATS and the TOEFL have adopted online testing via e-proctoring methods to cater students to attend these tests from the comfort of their homes. Schools and colleges need to understand the nuances of online testing in terms of procedures to be followed, kind of questions to be set, assessment schemes and so on. Online testing and E-proctoring are already prevalent in many MOOCs and the surging demand also paved the way for newer sophisticated software which was seen replacing (Alessio et al., 2018; Daffin Jr. & Jones, 2018) the once dominated modes of virtual proctoring such as video conferencing (Hylton et al., 2016; Weiner & Hurtz, 2017). Platforms like the Mettl, Proctorio, Examity, Proctoru, and Proctortrack have gained significant recognition during the pandemic (Ching, 2020). They replaced the online virtual video conference proctoring to a software based proctoring (Alessio et al., 2018; Daffin Jr. & Jones, 2018). Newer online testing software has features such as proctoring, question paper releasing, answer script submission, anonymity of student submissions, and evaluation system. Halem et. al. (2021) says it would be surprising to view the future that replaces the traditional human proctored examination by virtual mode.

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Globally, student population is faced with high level of anxiety and stress (Afsar & Kulsoom, 2015; Bayram & Bilgel, 2008). Even though the impact of Covid-19 has brought about deteriorating effects on the mental health of the population (Roy et al., 2020; Xiao, 2020) and measures were taken to diagnose such issues, the mental health among the students was relatively ignored (Lee, 2020; Xiang et al., 2020). While some studies showed that teachers and students provided positive feedback on online proctoring (Craig et al., 2020; Munshi et al., 2020; Reid & Sam, 2020) the newer practice of evaluating the students online was adding on the existing issues in the prevailing education system during the pandemic (Cao et al., 2020; Talidong & Toquero, 2020). Studies revealed that anxieties related to examinations and tests are the most common forms amidst students in the higher education (Furr et al., 2001) and often displayed in the form of discomfort, sadness, and regret. These emotions piled up as a result from previous test experiences and affect the self-esteem and motivation of oneself (Sari et al., 2018; Stöber, 2004; Larreamendy-Joerns & Leinhardt, 2006; Sansgiry & Sail, 2006). Even causing students to drop-out or instigate suicidal tendencies (Schaefer et al., 2007). Given the current issues that online mode of learning is faced, which is aggravating the further inequality in education (Jæger & Blaabæk, 2020; Thomas & Rogers, 2020). Studies during pandemic pertaining to online teaching, online learning, and online testing have mostly focused on technological support needed for them. Whereas students studying in crucial academic stage like grade 11 or 12 have suffered the consequences of this initial technological adaptation. Therefore, there is a need for in-depth understanding of consequences faced by students due to online teaching and testing. Thus, present study aims to understand whether e-proctored online testing has created exam anxiety among students and thereby affected their academic performance.

Context of the Present Study

The IB Diploma programme is a globally recognized university entry qualification. Students studying in this programme have a well-defined plan for their higher studies and usually join the top universities around the world. Students who opted higher level Mathematics and Sciences in the diploma programme aim to take up their higher studies in STEM education. Outbreak of Covid-19 has left them disturbed. Nevertheless, it forced students onto online classes, e-proctored online examination, and its evaluation. This situation is not limited to IB school board alone but may be true for the other school boards as well. Researchers of the study have witnessed it and therefore have planned to conduct the present research. Researchers were quite inquisitive to know whether e-proctored online test caused anxiety among students and affected their performance in pre-board examination. There is also gender-science stereotype in many parts of the world as reported by world economic forum (WEF, 2017). Researchers in the present study also planned to see the differences in online test anxiety and performance in STEM subjects based on gender. Results of the present study have potential to inform the IB and other education system on anxiety faced by the students in remote testing and the way their performance was affected especially at their crucial stage of school education.

There exists a negative correlation between exam anxiety and exam performance as per the reviews around six decades. However, in the present study the conditions are different due to Covid-19. Students are used to face-to-face examination and were asked to take up online examination all of a sudden therefore, it certainly adds on to the usual exam anxiety. E-proctoring these online exams further aggravates it. Students studying in IB DP are usually from a higher socio-economic status. They are hoping to join higher education in the best universities of the world. Therefore, measuring situational anxiety gains importance, and performance of students seriously matters at this crucial educational stage in their lives. Students who have opted for STEM subjects are generally hoping for a bright future in sciences. Outbreak of Covid-19

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has brought a lot of uncertainty in students' academic future. Therefore, present study was an attempt to understand whether online exam anxiety under e-proctored condition is affecting their performance especially in STEM subjects.

Research Objectives

- To find whether there is a relationship between online test anxiety faced by the IB DP students and their academic performance.
- To find out whether the variation in academic performance is explained by e-proctored online test anxiety faced by the IB DP students.
- To find out whether there is any difference in online test anxiety and academic performance in STEM subjects among boys and girls
- To find out whether there is any difference in online test anxiety and academic performance in STEM subjects among first year and final year IB DP students

Hypotheses

- There is no significant relationship between online exam anxiety and academic performance in STEM subjects of IB DP students
- Online exam anxiety is not a significant predictor of academic performance of IB DP students in STEM subjects
- There is no significant statistical difference between online exam anxiety and academic performance in STEM subjects of IB DP boys and girls.
- There is no significant statistical difference between online exam anxiety and academic performance in STEM subjects of first and final year IB DP students

Research Methodology

General Background

The present study employed quantitative descriptive research survey design to address the research objectives framed for the study. The study planned to collect data from the survey questionnaire during the pre-board examination of IB DP students, which is planned to be conducted online on an e-proctored mode. The study sample is limited to the IB students of first and final year diploma programme. Researchers included students from only those schools, which accepted our request to conduct the study. Usually, number of students in IB DP is less unlike other school boards. Therefore, the sample size is limited to 200 only altogether.

Sample

Study employed convenient sampling technique and planned to collect data from international schools located in India and offering IB diploma programme. Study included 200 students studying in IB diploma programme, which includes 78 boys, 122 girls, 61 first year diploma students, and 139 from final year diploma programme. Study included only those who have taken STEM related subjects for their diploma programme. Study sought permission from the schools, first, for collecting the data and then from students and their parents. It included assent form for students and consent form for parents. Study also sought institutional ethical clearance to conduct the present study. Researchers assured the confidentiality of the data collected to the school heads, students, and their parents. The data is encrypted and is accessible only to the researchers.

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Instrument Used

The present study used online test anxiety inventory (OTAI) developed by Alibak et. al. (2019) to measure the test anxiety of IB DP students before their pre board exams. Researchers verified the adequacy and suitability of the instrument by obtaining the face and content validity of the items from a panel of experts. The study established reliability of the instrument using Cronbach alpha reliability statistics and found reliability coefficient of 0.892, which indicates that the instrument is highly reliable (Nunnally, 1979).

Data Collection Procedure

Researchers visited the schools selected for the study and obtained permission from the heads of the schools to collect the required data. Researchers circulated the survey questionnaires to first year and final year IB DP students of the schools prior to their pre board online examination. Survey questionnaire had consent forms and social demographic details in the first section and second section had items of OTAI instrument. Researchers assured anonymity of the data collected to students, parents, and school authorities. Out of the total responses, the researchers included 200 completely filled responses for the study. Once the pre board examination and its evaluation were over, the researchers collected, students' average-score grades of STEM related subjects. Researchers cleaned the data and then fed into SPSS version 24 to carry out the quantitative data analysis.

Data Analysis

The study used correlation test, simple linear regression analysis, independent sample t-test, and analysis of variance (ANOVA) test to test the statistical significance of the hypotheses framed for the present study. The results are presented in the following section.

Research Results

Researchers conducted Pearson correlation test to find out the relationship between online test anxiety and academic performance of IB DP students. Nevertheless, the study tested whether the obtained relationship is true even in case of demographic variables such as gender and studying year of IB DP. Table 1 shows the results of the correlation test.

Table 1
Pearson Correlation Statistics

Variables	Performance in STEM Subjects				
	Overall	Boys	Girls	First year DP	Final year DP
Online Test anxiety	-.376**	-.283**	-.433**	-.374**	-.333**

**. Correlation is significant at the .01 level (2-tailed)

As shown in Table 1, there is a moderate negative correlation between online test anxiety and performance of students in STEM subjects (r = -.376). To any increase in online test anxiety there is a corresponding proportionate decrease in the performance in STEM subjects' grade.

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Online test anxiety negatively correlated to boys, girls, first year, and final year DP students' performance in STEM subjects. All these negative correlations are statistically significant at .01 level.

The regression analysis was to understand the total variation in the Performance of students in STEM subjects (dependent variable) as explained by the online exam anxiety under e-proctored condition (independent variable). Research data met all the assumptions required of regression analysis. As shown in Table 2, it is clear that the correlation between student performance in the STEM subjects and their online exam anxiety is 0.376 indicating moderate correlation. 14.1% of the variation in students' performance in STEM subjects' is because of the online exam anxiety they have under e-proctored condition (Quirk, et al., 2021).

Table 2
Model Summary Statistics of Regression

Model summary[a]						
Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the estimate	Change statistics	
					R Square Change	*F* change
1	.376[a]	.141	.137	1.15705	.141	32.584

a. Predictors: (Constant), Exam anxiety

Durbin-Watson statistical test conducted to find out the auto-correlation in the residuals from regression analysis. The result of the auto-correlation between online exam anxiety and STEM subjects' average grade points presented in Table 3 shows that there is a slight positive autocorrelation (1.785) between the variables.

Table 3
Durbin-Watson Statistics

Model	Change Statistics			Durbin-Watson
	df1	*df2*	*Sig. F Change*	
1	1[b]	198	.0001	1.785

b. Dependent Variable: STEM subjects average grade points

ANOVA output of the regression analysis presented in Table 4 explains how well the regression equation and model fits the data. Regression model significantly predicts the dependent variable ($p < .05$) that means online exam anxiety predicts performance in STEM subjects.

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Table 4
ANOVA Statistics

ANOVA[a]						
Model		Sum of Squares	*df*	Mean Square	*F*	*p*
1	Regression	43.622	1	43.622	32.584	.0001[b]
	Residual	266.076	198	1.339		
	Total	308.698	199			

a. Dependent variable: STEM subjects average grade points (Exam performance)
b. Predictors: (Constant), Exam anxiety

The regression model coefficients presented in Table 5 determine whether online exam anxiety statistically significantly contributes to the model. As shown in Table 5 online exam anxiety contributes significantly to the model and is able to predict students' performance in STEM subjects. A regression equation formed out of the unstandardized coefficients (B) value is; STEM subjects average grade point = 6.540 + (-0.033) x (exam anxiety).

Table 5
Showing Regression Coefficients Statistics

Coefficients [a]								
Model		Unstandardized Coefficients		Standardized Coefficients	*t*	*p*	95.0% Confidence interval for *B*	
B		Std. Error	Beta			Lower bound	Upper bound	
1	(Constant)	6.540	.281		23.243	.0001	5.985	7.095
	Exam anxiety	-0.033	.006	-.376	-5.708	.0001	-0.044	-.021

a. Dependent variable: STEM subjects average grade points

In order to test whether there is any difference in online exam anxiety and academic performance in STEM subjects among boys and girls studying in IB DP, the study conducted independent sample t-test. Table 6 shows the results of the independent sample t-tests.

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Table 6

Independent Sample t-Test for Exam Anxiety and Academic Performance with Gender

		Levine's Test for Equality of Variances		t-test for Equality of Means						
		F	*p*	*t*	*df*	p (2-tailed)	Mean Difference	Std. Error Difference	95% CI Difference	95% CI Difference
								Lower	Upper	
Exam anxiety	Equal variances assumed	.016	.898	.427	198	.670	.892	2.090	-3.229	5.014
	Equal variances not assumed			.425	161.219	.672	.892	2.102	-3.258	5.042
Performance in STEM subjects	Equal variances assumed	.100	.752	-1.115	198	.266	-.20120	.18045	-.55705	.15466
	Equal variances not assumed			-1.123	168.327	.263	-.20120	.17909	-.55475	.15235

Table 6 shows that, there is no significant difference in online exam anxiety among boys and girls studying in IB DP (t_{198} = 0.427, p = 0.670). Therefore, the null hypothesis is accepted, and alternative hypothesis rejected. Nevertheless, there is no significant difference in academic performance in STEM subjects among boys and girls studying in IB DP (t_{198} = -1.115, p = 0.266). Therefore, the null hypothesis is accepted, and alternative hypothesis rejected.

In order to test whether there is any difference in online exam anxiety and academic performance in STEM subjects among first year and final year students studying in IB DP, the study conducted independent sample t-test. Table 7 shows the results of the independent sample t-tests.

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Table 7
Independent Sample t-Test of Exam Anxiety and Academic Performance with II and I DP

		Levine's Test for Equality of Variances		t-test for Equality of Means						
		F	*p*	*t*	*df*	*p* (2-tailed)	Mean Difference	Std. Error Difference	95% CI Difference	95% CI Difference
									Lower	Upper
Exam anxiety	Equal variances assumed	.010	.919	2.714	198	.007	5.903	2.175	1.614	10.193
	Equal variances not assumed			2.718	115.038	.008	5.903	2.172	1.602	10.205
Performance in STEM subjects	Equal variances assumed	.316	.575	-3.547	198	.0001	-.65959	.18595	-1.02629	-.29290
	Equal variances not assumed			-3.471	109.044	.001	-.65959	.19006	-1.03628	-.28291

Table 7 shows that there is a significant difference in online exam anxiety among first and final year IB DP students ($t_{198} = 2.714$, $p = .007$). Therefore, the null hypothesis is rejected, and alternative hypothesis is accepted. Online exam anxiety of first year DP students' is more than final year students' ($M_{first} = 51.33$, $M_{final} = 45.42$). Nevertheless, there is a significant difference in academic performance in STEM subjects among first and final year IB DP students ($t_{198} = -3.547$, $p = .0001$). Therefore, the null hypothesis is rejected, and alternative hypothesis is accepted. Performance in STEM subjects of first year DP students' is less than final year students' ($M_{first} = 4.5451$, $M_{final} = 5.2047$).

Discussion

In the past two decades, there is an increase in the online educational programmes in western education system especially in United States and Canada. This is posing a challenge to exam integrity and there is variation in exam anxiety of the learners. Earlier studies mention that to save time and to make examinations cost effective, many educational programmes do conduct e-proctored online examination. Several survey research have shown that learners misconduct if they get a chance and on contrary to this, if e-proctored method is used to reduce misconduct during online testing, there is additional exam anxiety (Witherspoon et al., 2012; Karim et al., 2014). Studies since last 4 decades have found that test anxiety negatively affected academic performance (Huberty, 2009). In the study conducted by Cassady (2009) it is found that, test anxiety is a situation specific type of trait anxiety. Therefore, measuring test anxiety during Covid-19 pandemic situation gains unique importance and especially with International baccalaureate diploma programme students who are aspiring to join the world's best higher education Universities. Interestingly present study found 14.1% of their performance is affected by additional test anxiety, which is huge in an educationally competitive world.

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Study revealed a negative correlation between online test anxiety and overall performance in STEM subjects and it is true for subgroups of the sample: boys, girls, first year, and second year IB DP students. This result is in agreement with the recent study conducted in an US university (Woldeab & Brothen, 2019). Earlier studies clearly suggested exploring the relationship of online test anxiety and exam performance, accordingly the present study found that, online exam anxiety under e-proctored condition has affected the students' performance in their examination. 14.1% of variation in the exam performance is due to online exam anxiety faced by the students under e-proctored condition. This test anxiety as supported by earlier study is, a condition or situation specific (Cassady, 2010). Study revealed that online exam anxiety is the same across boys and girls. Their performance in STEM subjects also did not differ. However, there is a significant difference in online exam anxiety between first year and final year IB DP students under e-proctored condition. First year students have shown more anxiety than final year DP students have. This could be due to the unexpected prevailing covid situation and perceived online test anxiety and uncertain future ahead.

Nevertheless, first year students' performance in STEM subjects is lower than the final year students' performance as they had higher anxiety. The proctor intrusiveness causes higher anxiety as explained by Woldeab and others (Woldeab et. al., 2017). Overall, online exam anxiety affected the academic performance of IB DP students, therefore schools have to work towards the strategies to reduce online exam anxiety. Induction programmes on nature and procedures of online examination may help students overcome their anxiety. Counselling support programmes to deal with academic pressure, global competitions, coping-mechanisms, and mental health techniques may help in reducing anxiety of students, which in turn may enhance their performance in the upcoming examination be it final board exams and entrance examination. Interestingly pre-university college (PUC) board in Karnataka state of India gave their final PUC results based on student's performance in their grade 10, first PUC, and internal assessments in final PUC. Being Government college education board, it did not go for any online testing and e-proctoring system. As diploma programme is a crucial stage of their school education and determines their future education, stakeholders must pay attention to the outcome of the present study. The study strongly recommends qualitative research to capture the detailed account of their anxiety affecting performance, which helps the stakeholders to take care of such future situations.

Conclusions and Implications

As intended, the study was able to find the relationship between online test anxiety and students' performance in STEM subjects in an e-proctored online examination and it is negative. Further exploration of the relationship found that, online test anxiety explained 14.1% of exam performance. The study revealed that, there is no difference in online test anxiety and exam performance in STEM subjects with respect to gender. However, the differences were found in online test anxiety and exam performance in STEM subjects between first year and final year IB DP students. Few of the limitations of the study are: the study included exam performance in STEM subjects only, drawn sample from students studying in international baccalaureate diploma programme only, and socio demographics considered are gender and study years only. The study can be conducted to a larger sample and to different types of student populations for more comprehensive results. However, the study clearly points out the need for taking careful steps by stakeholders while taking academic decisions especially in 11 and 12 grades level of education. The study recommends future researchers to work on reducing proctor intrusiveness and develop newer technologies for tensionless conduct of remote or online examination.

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Conflict of Interest

The authors have no conflicting interest towards this publication. All have contributed to the work. The authors thank all those who cooperated for the data collection.

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