

Face-to-face, Blended or Online: How do Students Prefer to Study?

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The article presents the findings of a study on the learning format preferences in students of the Moscow State University of Psychology & Education (N=761) in February-March 2022. Face-to-face learning (FTF) was chosen by 10.8% of students, blended learning (lectures in distance format, seminars and practical classes in-person) (BL) — 39.7%, distance learning (DL) — 49.5%. There were no differences between the 3 groups by gender and age. In the BL group, compared to the DL group, logical thinking ($p=0.001$) and verbal intelligence ($p=0.003$) are better developed, natural science literacy rates are higher ($p=0.018$), there is a better understanding of the vaccination benefits against COVID-19 for the individual and society ($p=0.016$) and less confidence in serious negative consequences of the coronavirus vaccine ($p=0.005$). In the FTF group, compared to the DL group, there is a lower fear of COVID-19 disease ($p=0.050$) and a higher estimate of the vaccination benefits against COVID-19 for an individual and society ($p=0.050$). Cluster analysis using K-means method identified 2 clusters. Cluster 1 includes respondents with more developed logical thinking, verbal intelligence, better natural science literacy, better understanding of the vaccination benefits against COVID-19 for a person and society and less prone to various fears, doubts, underestimation of the danger of coronavirus and distrust of vaccination. In Cluster 1, as compared to Cluster 2, the share of respondents preferring BL prevails (44.4% vs 37.1%), and the share of those who prefer DL is lower (43.8% vs 52.6%); the differences are significant at the trend level. The shares of respondents preferring FTF are practically the same and make up only about 10%. Using the method of logistic regression analysis, 4 statistically significant predictors were identified and a model was built to predict the respondents' choice of the BL vs DL. The older the respondent, the more pronounced his/her fear of COVID-19, the lower his/her logical thinking, and the less confident (s)he is in the vaccination benefits against coronavirus for the individual and society, the more likely (s)he is to prefer DL over BL. Conversely, BL is more likely to be preferred over DL by younger respondents with higher logical reasoning scores, less fear of COVID-19 disease, and greater confidence in the vaccination benefits against coronavirus for the individual and society. The overall prediction accuracy of the model is 60.4%.

Keywords: vaccination, COVID-19, prevention, vaccination attitude, blended learning, distance learning, face-to-face learning.

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Очный, смешанный или онлайн-формат: как предпочитают учиться студенты?

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Представлены результаты исследования предпочтений формата обучения студентами вуза на примере Московского государственного психолого-педагогического университета (N=761). Исследование проведено в феврале-марте 2022 года. Установлено, что очный формат (ОФ) выбрали 10,8% студентов, смешанный формат (СФ) — 39,7%, дистанционный формат (ДФ) — 49,5%. Различий между 3-мя группами по полу и возрасту не выявлено. В группе СФ по сравнению с ДФ лучше развиты логическое мышление ($p=0,001$) и вербальный интеллект ($p=0,003$), выше показатели естественно-научной грамотности ($p=0,018$), лучше понимание пользы вакцинации от COVID-19 для человека и общества ($p=0,016$) и меньше уверенность в серьезных негативных последствиях вакцины от коронавируса ($p=0,005$). В группе ОФ по сравнению с ДФ ниже страх заболевания COVID-19 ($p=0,050$) и выше оценки пользы вакцинации от коронавируса для человека и общества ($p=0,050$). Кластерный анализ методом К-средних позволил выделить два кластера. Кластер 1 — это респонденты с более развитым логическим мышлением, вербальным интеллектом, лучшей естественно-научной грамотностью, лучше понимающие пользу вакцинации от COVID-19 для человека и общества и менее подверженные разнообразным страхам, сомнениям, недооценке опасности COVID-19 и недоверию к вакцинации. В Кластере 1 по сравнению с Кластером 2 преобладает доля респондентов, предпочитающих СФ (44,4% vs 37,1%), и меньше доля предпочитающих ДФ (43,8% vs 52,6%), различия значимы на уровне тенденции. Доли респондентов, предпочитающих ОФ, практически одинаковы и составляют всего около 10%. Методом логистического регрессионного анализа выделены 4 статистически значимых предиктора и построена мо-

дель, позволяющая предсказать выбор респондентами формата СФ vs ДФ. Чем старше респондент, тем сильнее у него выражен страх заболевания COVID-19, чем меньше показатели его логического мышления и чем менее он уверен в пользе вакцинации от COVID-19 для человека и общества, тем более вероятно, что он предпочтет ДФ по сравнению с СФ. Наоборот, СФ является скорее предпочтительным по сравнению с ДФ для более молодых респондентов с более высокими показателями логического мышления, меньшим страхом заболевания COVID-19 и большей уверенностью в пользе вакцинации от COVID-19 для человека и общества. Общая точность прогноза модели равна 60,4%.

Ключевые слова: вакцинация, COVID-19, профилактика, отношение к вакцинации, смешанное обучение, дистанционное обучение, очное обучение.

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Introduction

The digital transformation of education in Russia is one of the priority areas of the state policy. Higher education institutions are frequently looking for new digital ways to improve the quality of education, increase students' engagement and manage knowledge resources. In assessing the effectiveness of training, it seems important to overcome the dichotomy of choosing online education and traditional full-time education and draw special importance to blended learning, which in many ways unites the past and the future in education [2; 7; 10]. The report [3] at the II All-Russian Conference with international participation “Digital Humanities and Technologies in Education (DHTE 2021)” notes that, according to the annual monitoring of the education economy for 2020—2021, implemented by the National Research University Higher School of Economics, the educational process at Russian universities in 2020-2021 has undergone a major transformation: digitalization processes have unfolded at a faster pace, new models of training courses have begun to be mastered (blended learning, learning using MOOCs), and a large number of new digital technologies are used at universi-

ties. Accelerated digitalization of the educational process is seen in the report as a growing window of opportunity. At the same time, in the implementation of blended and distance learning formats, the key challenges for students are the problems of self-regulation and use of learning technologies. On behalf of educational institutions, the main problem is to provide support for teachers in the learning process [20].

According to the results of studies on the effectiveness of teaching mathematical methods in psychology and education based on electronic learning courses (ELC) conducted at Moscow State University of Psychology and Education in 2019—2021, students of bachelor's, specialist's and master's degrees positively assess mixed and distance formats [11] and, which is very important, show high educational results in both formats [12]. The model of learning based on a blended format also shows its effectiveness in improving the natural scientific literacy of students [19].

Sociological research shows that the way students prefer to study depends, among other things, on the chosen direction of education. So, in 2021 in Russia, IT professions (more than 2.5 million people) and professions in the

field of education (more than 2.2 million people) became the most massive areas in online education. In offline, the most popular areas were manufacturing, construction and repair (more than 1.5 million people studied). In the second place are IT professions and marketing (more than 1.4 million people) [4]. At the same time, one of the significant goals of education is the ability of the students themselves to assess the relevance of scientific knowledge and practices, and use them in solving a wide range of personal and social problems.

In the context of the ongoing COVID-19 pandemic, the scientific literacy of citizens is turning from a subject of sociological research into a question of the survival of the society itself due to the attitude of various social groups and individuals towards the issues of disease prevention and vaccination. This ratio reflects the real state of scientific literacy and reveals significant problems in its formation [8]. Presumably, the position regarding COVID-19 vaccine prevention, which may be associated with the ability to critically analyze large amounts of conflicting information of a natural science nature in order to evaluate it and select the most reliable sources, as well as the general level of intellectual development, and fear of infection with coronavirus, may be associated with the choice of educational format for university students. Indeed, the student audience is the most active social group in terms of communication, which is one of the risk factors for the spread of the virus during the COVID-19 pandemic.

The attitude of university students to the transition to distance forms of education during the COVID-19 pandemic is becoming the subject of numerous studies. Thus, on the example of studying the attitude of future doctors to distance education at Privolzhsky Research Medical University of the Ministry of Health of Russia, it is shown that, taking into account the objective situation, almost all students positively assess the introduction of distance education at the University. At the same time, among the positive features of distance learning, students most often note saving time and

money on the road, the comfort of studying at home, the ability to choose the optimal pace of mastering the material [6]. Another example of the attitude of university students to distance education during the COVID-19 pandemic is shown in a study conducted on the basis of the Faculty of Dentistry of Altai State Medical University of the Ministry of Health of Russia. A survey of students showed that, in general, they are satisfied with the distance learning process, highly appreciating the content and presentation of educational information. Problems and difficulties that arise during the development of educational programs are mainly related to technical issues. However, according to the majority, distance learning cannot fully cover the practical part of the training of a future doctor, and the distant format can only be considered as an alternative to traditional education in the context of the COVID-19 pandemic [13]. At the same time, the overall level of satisfaction with distance learning in medical universities is much higher among students who have had previous distance learning experience, as well as when teachers actively participate in training sessions, using multimedia technologies and devoting sufficient time to classes [14]. In a review of the digitalization of medical education in Germany, S. Kuhn et al. [18] emphasizes the growing relevance of mobile, interactive and personalized formats and digital learning platforms.

The purpose of the study: to identify the characteristics of respondents who prefer different formats of education, regarding their age, development of intelligence and natural science literacy, as well as their attitude to vaccination against COVID-19.

Research questions:

RQ1: In the context of the COVID-19 pandemic, how do students feel about different formats of learning, and what might these preferences be related to?

RQ2: What are the generalized characteristics of respondents who prefer different learning formats?

RQ3: Which of the parameters of attitudes towards COVID-19 vaccination and the intellec-

tual sphere can be predictors of respondents' preference for one of the learning formats?

Materials and Methods

Description of the study design. Students of Moscow State University of Psychology and Education (hereinafter referred to as MSUPE) took part in the study. As part of the verification of the program of educational activities in the field of COVID-19 vaccine prevention, the attitude of students to vaccination against COVID-19 infection was studied in conjunction with their natural science literacy and other characteristics. The data was collected in February and March 2022. The study was approved by the Ethics Committee of the MSUPE (Protocol No. 8 dated December 15, 2021). Testing was carried out anonymously in computer form by the Department for Monitoring the Quality of Vocational Education (DMQVE) MSUPE. Participation in testing was voluntary, students gave informed consent.

Description of the sample. The sample consisted of N=761 bachelor's, specialist's and master's students of Moscow State University of Psychology and Education, who, in addition to other tests, filled out the Questionnaire on attitudes towards vaccination against COVID-19 before and after the formative experiment: of them, men — 19.2% (N=146), women — 80.8% (N=615). In the process of calculations, the sample size could decrease, because not all students completed the entire battery of tests.

At the ascertaining stage, the question was asked: "What format of training is preferable for you after January 31 with the improvement of the epidemiological situation? (Single Choice)." Among N=761 respondents of the analytical sample, 10.8% (N=82) students chose the face-to-face format (FTF), blended format (lectures — in a distant format, seminars, practical classes — full-time) (BF) — 39.7% (N=302), distant format (DF) — 49.5% (N=377). Comparison of the distributions of men and women according to the 3 preferred training formats (groups FTF, BF and DF) did not reveal any differences (Chi-square, $p=0.127$). Distribution

of male respondents in 3 groups — 14.4% vs 33.6% vs 52.1%, women — 9.9% vs 41.1% vs 48.9%. Thus, among respondents of both sexes, about 50% choose DF, about 35%—40% — BF, and about 10%—15% — FTF. Comparison of 3 groups by age, see below (Table 1).

Diagnostic tools

1. A Questionnaire on Attitudes towards Vaccination against COVID-19, including 34 statements with response options on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). Based on this questionnaire, a standardized questionnaire "Scale of Attitudes towards Vaccination against COVID-19" was developed [9].

2. Adapted and modified TOSLS Test for Assessing Science Literacy [17].

3. A Test for Assessing Logical Thinking — Raven's Test (abbreviated version of "Advanced Progressive Matrices by J. Raven") [16].

4. Test for Assessing Verbal Intelligence (created on the basis of the Amthauer intelligence structure test) [1].

5. COVID-19 Disease Fear Scale [15], Russian translation and adaptation by T.L. Kryukova and others [5].

Methods for quantitative data analysis: descriptive statistics, one-way ANOVA, Chi-square homogeneity test, Kolmogorov-Smirnov test, exploratory factor analysis, k-means cluster analysis, logistic regression analysis. Quantitative data analysis was performed in SPSS V.23.

Results

Determination of aspects of attitude to vaccination. To study the effectiveness of the formative experiment on the initial sample of N=1984 students who filled out the Questionnaire for Attitudes towards Vaccination against COVID-19 at the entrance, exploratory factor analysis (EFA), the method of principal components, Varimax rotation was carried out for 34 items of this Questionnaire. Five factors explaining respectively 22.3%, 11.7%, 11.1%, 9.35 and 6.6% of the total variance, in the amount of 61.1% were identi-

fied. The values of $KMO=0.961$ and Bartlett's sphericity criterion ($Chi-square=41241.015$, $df=561$, $p=0.000$) indicate good factorizability of the correlation matrix. Based on the matrix of rotated components and factor loadings of the Questionnaire items, the factors were interpreted as 5 scales reflecting various aspects of attitudes towards vaccination: Scale 1 "Benefits of covid vaccination for humans and society" (10 points), Scale 2 "Denial of the danger of coronavirus and hope for natural immunity" (8 points), Scale 3 "Fear of the side effects of COVID-19 vaccination and distrust of information about the safety of vaccination" (7 points), Scale 4 "Confidence in the serious negative consequences of the coronavirus vaccine" (5 points), Scale 5 "Dis-

belief in the proven effectiveness of Russian vaccines at the international level" (4 points).

The evaluation of differences between 3 groups of respondents who prefer different formats of education were assessed on 5 selected aspects of attitudes towards vaccination and 4 measured parameters — SLT, indicators of intelligence and fear of COVID-19 disease.

Table 1 presents descriptive statistics and results of analysis of variance (1-way ANOVA). Statistically significant differences were revealed for 5 measured parameters (bold in Table 1): age, logical thinking (Raven Test), Science Literacy Test (SLT), COVID-19 Disease Fear Scale, Verbal Intelligence Test (VI). Different sample sizes are explained by the fact that not all students completed all of the listed tests.

Table 1

Descriptive statistics and ANOVA results for measured parameters for 3 preferred learning formats

		N	M	SD	St. Error	Min	Max	F	p
Age	FTF	82	21.59	5.62	.621	18.00	53.00	3.538	.030*
	BF	302	22.61	7.09	.408	17.00	53.00		
	DF	377	23.63	7.37	.380	17.00	56.00		
	Total	761	23.01	7.12	.258	17.00	56.00		
Logical Thinking Evaluation Test — Ravens' Test	FTF	78	7.33	2.92	.331	1.00	12.00	6.864	.001***
	BF	294	7.81	2.81	.164	0.00	12.00		
	DF	352	6.97	2.95	.157	0.00	12.00		
	Total	724	7.35	2.92	.108	0.00	12.00		
Scientific Literacy Test — SLT	FTF	79	15.45	5.23	.588	4.00	27.00	4.124	.017*
	BF	293	16.25	4.65	.271	5.00	27.00		
	DF	356	15.17	4.87	.258	4.00	25.00		
	Total	728	15.64	4.84	.179	4.00	27.00		
COVID-19 Disease Fear Scale	FTF	80	12.61	4.22	.472	7.00	24.00	3.881	.021*
	BF	289	13.30	4.32	.254	7.00	29.00		
	DF	344	14.04	5.12	.276	7.00	35.00		
	Total	713	13.58	4.73	.177	7.00	35.00		
Verbal Intelligence Test (VI)	FTF	76	24.80	9.34	1.07	4.00	39.00	5.790	.003**
	BF	282	26.21	9.19	.547	0.00	39.00		
	DF	338	23.62	9.71	.528	1.00	40.00		
	Total	696	24.80	9.53	.361	0.00	40.00		

Notes: * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

The post hoc method of paired comparisons according to Scheffe does not reveal age differences. Let's pay attention (see Table 1) that the age range for all 3 groups is almost the same — from 17—18 to 53—56 years. In the BF group, compared to the DF group, logical thinking is slightly better developed ($7.81 > 6.97$, $p=0.001$), the SLT test scores are higher ($16.25 > 15.17$, $p=0.018$), and verbal intelligence is better developed ($26.21 > 23.62$, $p=0.003$). In the FTF group, compared with the DF group, the fear of COVID-19 disease was lower ($12.61 < 14.04$, $p=0.050$). However, the size of the Cohen effect d is everywhere small and does not exceed 0.3. No other pairwise differences were found.

Table 2 presents descriptive statistics and results of analysis of variance (1-way ANOVA)

for 5 scales that characterize the attitude of respondents to vaccination against COVID-19. Statistically significant differences (highlighted in bold) were found only on Scales 1 and 4 ($p=0.004$, $p<0.01$).

Scheffe's post hoc pairwise comparison method reveals the following differences (see Table 2, in bold). In the BF group, compared to the DF group, scores are higher on Scale 1 "Benefits of COVID-19 vaccination for the individual and society" ($41.80 > 38.53$, $p=0.016$) and lower scores on Scale 4 "Confidence in the serious negative consequences of the coronavirus vaccine" ($12.90 < 14.34$, $p=0.005$). In the FTF group, compared with the DF, the scores on Scale 1 "Benefits of vaccination against COVID-19 for the individual and society" are higher ($42.92 > 38.53$, $p=0.050$). This is quite consistent with common

Table 2

Descriptive statistics and ANOVA results on scales 1—5 of the COVID-19 vaccination attitude questionnaire for 3 preferred learning formats

Scale/Group	N	M	SD	St. Error	Min	Max	F	p
Scale 1	FTF	82	42.92	13.54	1.496	10.00	5.602	.004**
	BF	302	41.80	14.73	0.847	10.00		
	DF	377	38.53	14.88	0.766	10.00		
	Total	761	40.30	14.77	0.535	10.00		
Scale 2	FTF	82	27.12	10.53	1.163	10.00	2.444	.088
	BF	302	25.33	9.75	0.561	8.00		
	DF	377	26.96	10.30	0.530	8.00		
	Total	761	26.33	10.13	0.367	8.00		
Scale 3	FTF	82	29.15	8.18	0.903	13.00	.867	.421
	BF	302	28.26	8.50	0.489	7.00		
	DF	377	29.09	8.81	0.453	7.00		
	Total	761	28.76	8.62	0.312	7.00		
Scale 4	FTF	82	13.41	5.78	0.638	5.00	5.502	.004**
	BF	302	12.90	5.49	0.316	5.00		
	DF	377	14.34	5.78	0.297	5.00		
	Total	761	13.67	5.70	0.206	5.00		
Scale 5	FTF	82	15.19	5.65	0.624	4.00	1.100	.333
	BF	302	15.43	5.42	0.312	4.00		
	DF	377	15.96	5.56	0.286	4.00		
	Total	761	15.66	5.52	0.200	4.00		

Notes: ** $p<0.01$.

sense.

Generalized characteristics of respondents who prefer different learning formats. For the purpose of a generalized characterization of 3 groups — FTF, BF and DF — multivariate statistical methods were applied. **Cluster analysis using the K-means** method with preliminary standardization of all variables made it possible to divide the respondents into 2 clusters according to the total number of independent variables, which were: the SLT test, the Test for Logical Thinking Assessing — the Raven test, the Test for Verbal Intelligence and Scales 1—5 of the Attitude Questionnaire to Vaccination against COVID-19. The addition of the COVID-19 Fear Scale to this battery did not affect the results and would not add anything to their interpretation, as there were no differences between clusters in this parameter. Evaluation of the differences between the resulting clusters in terms of clustering parameters made it pos-

sible to characterize them as a whole. Then a comparison was made of the distributions of respondents in both clusters according to the preferences of various formats of education and interpretation of the results was given. Table 3 shows descriptive statistics of both clusters by clustering parameters.

The Mann-Whitney test revealed significant differences in all clustering parameters ($p < 0.001$ everywhere). In Cluster 1 (see Table 3), perceptions are higher in the Logical Thinking Test (8.21 > 6.53), the NSL test (17.75 > 13.86), the Verbal Intelligence Test (28.29 > 21.70). Scale 1 “The use of COVID-19 vaccination for the individual and society” (49.55 > 31.88) and a decrease below on Scale 2 “Denial of a health hazard and hope for natural immunity” (18.99 < 33.12), Scale 3 “Fear of side effects of vaccination against COVID-19 infection and distrust of information about the safety of vaccination” (23.29 < 33.96), Scale 4 “Confidence in the serious negative consequences of the

Table 3

Descriptive statistics of clusters 1 and 2 by clustering parameters

Cluste Number		Logicia Think- ing Test — Raven’s Test	SLT	VI	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5
Cluster 1	M	8.21	17.75	28.29	49.55	18.99	23.29	9.52	12.04
	N	328	328	328	328	328	328	328	328
	SD	2.63	4.11	7.99	12.17	6.37	6.58	3.38	4.60
	St. Error M	.145	.227	.441	.672	.351	.363	.187	.254
	E	0.045	0.180	0.587	0.241	0.560	-0.044	0.289	-0,655
	A	-0.670	-0.577	-1.112	-0.375	0.516	0.118	0.728	0,114
Cluster 2	M	6.53	13.86	21.70	31.88	33.12	33.96	17.41	18.88
	N	362	362	362	362	362	362	362	362
	SD	2.99	4.73	9.58	11.64	8.20	7.19	4.75	4.17
	St. Error M	0.157	0.248	0.503	0.612	0.431	0.378	0.250	0.219
	E	-0.781	-0.706	-0.955	-0.157	0.119	-0.397	0.691	-0.315
	A	-0.251	0.083	-0.222	0.004	0.511	0.025	0.397	0.081
Total	M	7.33	15.71	24.83	40.28	26.40	28.88	13.66	15.63
	N	690	690	690	690	690	690	690	690

vaccine against the disease” (9.52<17.41) and Scale 5 “Disbelief in assessing the effectiveness of the Russian vaccine at the international level” (12.04<18.88). No differences were detected between clusters by age (p=0.527). Thus, **Cluster 1 — respondents with more developed thinking, verbal intelligence, better NSL, better understanding of the use of COVID-19 vaccination for the individual and society and less presumed by widespread fears, doubts, underestimation of the danger of COVID-19 and distrust of vaccination.**

Comparison of distributed respondents of cluster groups according to preferences of different formats is presented in Table 4.

As can be seen from Table 4, in Cluster 1 in comparison to Cluster 2, the share of respondents who prefer BF prevails by 7.3% (44.4% vs 37.1%), and the share of those who prefer DF is 8.8% less (43.8% vs 52.6%). The differences are significant at the tendency level (Chi-square=5.185, p=0.075, p<0.1). Note that in both clusters, the shares of supporters of the BF and DF significantly prevail compared to the FTF. The shares of respondents who prefer FTF are practically the same and make up only about 10%.

The study of predictors of respondents’ preference for learning formats using the method of logistic regression analysis (LRA). LRA was applied to answer research question RQ3: Which of the measured param-

eters can be predictors of respondents’ preference for one of the learning formats?

Blended Format (BF) vs Distant Format (DF). As independent variables, the analysis included: Age, Logical Thinking (Raven Test), NSL, Verbal Intelligence Test, COVID-19 Disease Fear Scale, Scales 1—5 of the COVID-19 Vaccine Attitude Questionnaire. All independent variables are quantitative. Dependent variable: “Preferred learning format” is binary, it takes the values “BF=0” and “DF=1”. Sample size N=589 respondents who chose one of these 2 formats and completed the entire battery of the indicated tests.

A logistic model with 4 statistically significant predictors was built, which is described by the equation:

Predicted logit of (Preferred learning format) = 0.212 + (0.025)*(Age) + (-0.080)*(Raven’s Logical Thinking Test) + (0.048)*(COVID-19 Fear Scale) + (-0.017)*(Scale 1 “The benefits of vaccination against covid for the individual and society”).

According to this model, the logarithm of the values of the dependent variable is positively associated with age (B=0.025, p=0.040, p<0.05) and fear of COVID-19 (B=0.048, p=0.011, p<0.05) and negatively with logical thinking (B=-0.080, p=0.006, p<0.01) and with the idea of the benefits of vaccination against COVID-19 for the individual and society (B=-0.017, p=0.004,

Table 4

Distribution of respondents in clusters 1 and 2 according to the 3rd preferred learning formats

Cluster Number		Preferred training format after January 31 when the epidemiological situation improves (Single choice)			Total
		FTF	BF	DM	
Cluster 1	Quantity	38	144	142	324
	% in Cluster Number	11.7%	44.4%	43.8%	100.0%
Cluster 2	Quantity	36	130	184	350
	% in Cluster Number	10.3%	37.1%	52.6%	100.0%
Total	Quantity	74	274	326	674
	% in Cluster Number	11.0%	40.7%	48.4%	100.0%

$p < 0.01$). In other words, the older the respondent, the more pronounced his fear of COVID-19, the lower his logical thinking, and the less confident he is in the benefits of vaccination against COVID-19 for the individual and society, the more likely he is to prefer DF over BF. Conversely, BF is more likely to be preferred over DF by younger respondents with higher logical reasoning scores, less fear of COVID-19, and greater confidence in the benefits of COVID-19 vaccination for the individual and society.

The Hosmer-Lemeshov fit coefficient of the model (Chi-square=12.886, $df=8$, $p=0.116$, $p > 0.05$) is not statistically significant, which indicates a good fit. R-square of Cox and Snell is 0.046, R-square of Nagelkirk is 0.061, which may indicate a low percentage of variance of the dependent variable explained by the selected predictors.

Table 5 presents a classification table that reflects the ratio of cases of assigning respondents to one of the BF or DF formats correctly predicted by this model compared to the observed elections.

As can be seen from Table 5, the sensitivity of the model (70.7%) is higher than its specificity (48.5%). This means that the model correctly predicts the choice of the distant format (DF) 70% of the time, which is a very high result, but slightly less than 50% of the time it predicts the choice of the blended format (BF). Perhaps this is due to the fact that BF students often consider DF as the prevalence of online interaction, as their comments indicate. The overall prediction accuracy of the model is

60.4%, which is higher than the probability of random guessing. In general, the model should be considered satisfactory.

Attempts to construct similar models for the pairs FTF vs DF and FTF vs BF have failed. The first of them has a very low specificity (i.e., it does not predict belonging to an FTF), in the second model, not a single significant predictor was identified.

An interesting addition to the mathematical models can be the **respondents' comments** (from among MSUPE students) **about their choice of learning format**. They can be divided into three categories. The arguments for the **face-to-face format** are basically quite typical for its supporters in professional and student circles: the quality of education is low online, the face-to-face format is "fine", and it is easy to get distracted at home. Example: "The situation with COVID-19 will definitely not change in the near future. I don't want to spend the entire bachelor's degree at home. Studying at home is much worse (let's be honest at home it's very easy to get distracted). For 2 years at the University, I came to the Uni in person only a few times, I have a feeling that I am not studying at all." There is even a certainty that distance and isolation lead to mental disorders: "You can't keep people locked up, various mental deviations and nervous disorders may develop. In addition, the level of education is decreasing. At the same time, the numbers of sick and dead do not change. Not only do we not increase the number of healthy people, but we also make those who are healthy and who have good immunity sick. Moreover, mentally".

Table 5

Classification table of observed and predicted frequencies of preferred learning formats (BF vs DF) for the constructed LRA model

Observed		Predicted		
		Preferred learning format (BF vs DF)		% of correct predictions
		BF	DF	
Preferred learning format (BF vs DF)	BF	132	140	48.5
	DF	93	224	70.7
Total % share				60.4

Arguments in favor of the **distant format** are also quite typical for the professional and student community: this format is convenient for those students who live far, can not attend classes due to health reasons, family reasons, and it can be easily combined with professional activities of employed students. Here is a lively example of a statement in this category: “Very convenient format. People who study at the University are not children with undeveloped voluntary attention. They can control themselves. The distant format once again confirmed that they [students] listen and are not distracted when the lecture or seminar is interesting. If the teacher is not interesting for students, the information will be lost using any format of education”.

Perhaps the most numerous and curious were the comments of the proponents of the **blended learning format**. They offered various options of the mixed format, the most typical of which are practice and trainings — full-time, because they are less effective distantly, and all the rest is distantly. Examples of statements: “I prefer a blended format, but rather like this: lectures and seminars distantly, practice/trainings/etc. in full-time (what is really worse realized distantly)”; “Maximum distant, but practice and individual meetings with teachers, practical classes, group training — only in person”. Among the statements there were proposals to distribute time between face-to-face and distant formats: “50 to 50, a week of face-to-face classes, a week of distant classes”; “90% distance, 10% face-to-face”. Some respondents linked the choice of the format to the field of study and level of education: “Three times a month, face-to-face practical classes to add some rhythm to life, but distant learning is a more preferable option at the University. One should also take into account the areas of training, there are training areas and tracks where face-to-face meetings will really be required more often”, “Master’s degree distantly, bachelor’s degree full-time”.

Discussion

The study showed that the vast majority of university students of both sexes aged 17 to 56 prefer mixed or remote type of learning at a ratio of approximately 40% vs 50%, while full-time format — only about 10%. This is in good agreement with the conclusions of the study [3] and sociological survey [4] about the outstripping pace of digitalization of higher education in Russia and the growing market of online education. In addition, during the two years of the pandemic, students and teachers have learned to use the resources of the digital educational environment and gained extensive experience in the practical implementation of the educational process in both mixed and distant formats.

The formation of natural science literacy contributes to an active position in learning, and the development of critical thinking acts as the main strategy for the development of relevant competencies among students [8]. Students who prefer the mixed format have somewhat better developed logical thinking and science literacy, better understand the benefits of COVID-19 vaccination for the individual and society, and are less afraid of the serious negative consequences of the coronavirus vaccine. In turn, students who choose the face-to-face format show less fear of COVID-19 and are also more aware of the benefits of vaccination against coronavirus compared to those who choose the distant format. This is quite consistent with common sense: if students are aware of all this, then they are likely to be vaccinated, thereby protecting themselves and others from the danger of the disease and expanding the possibilities of contact in any format.

The results of cluster analysis, in general, correspond to the same logic. The first of the two selected clusters are respondents with more developed logical thinking, verbal intelligence, better science literacy, who better understand the benefits of vaccination against COVID-19 for an individual and society and are less prone to various fears, doubts, underestimation of the danger of COVID-19 and distrust

of vaccination. In this Cluster, compared to Cluster 2, the proportion of respondents who prefer BF prevails by 7.3%, and the proportion of those who prefer DF is 8.8% less. Note that in both clusters, the shares of supporters of the BF and DF significantly predominate compared to the FTF. The shares of respondents who prefer FTF are practically the same and make up only about 10%.

The results of logistic regression analysis demonstrate a rather low R-square (about 5-6%) and low prediction accuracy (about 60%). Obviously, preferences for distant or blended learning formats can be determined not only by the predictors used in the model, but also by some other variables not taken into account in the study. The search for such predictors requires further research. Note, however, that in this study we did not aim to identify all possible predictors, and also the fact that in real models using LRA, obtaining an overall prediction accuracy close to 100% with both high sensitivity and specificity is an extremely rare case due to the specifics of phenomena studied in psychology.

The results of this study are consistent with the results of the research project “Digital technologies in HE: development of a technology for individualization of learning by means of E-course”, implemented at MSUPE in 2019—2021 [11; 12], and statistically confirming high educational results and positive attitude of students towards both the BF and the DF.

Our results, the results of international and a number of Russian studies, as well as the significant efforts of the Ministry of Digital Development of the Russian Federation and the Ministry of Education and Science of the Russian Federation to develop digital competencies of university teachers who participated in the “Priority 2030” program, allow us to talk about the feasibility of institutionalizing blended and distance learning formats at the University and granting these formats equal rights compared to face-to-face format. The choice of BF or DF should be determined not by the epidemiological situ-

ation and / or formal criteria such as “more or less than 30 students in a group”, but by a confirmed agreement between the teacher and the deans of specific faculties. Such an agreement is based on other reasons, for example: the level of digital competencies of the teacher and his/her ability to work in a modern digital educational environment; the specifics of the subject; size, accessibility, availability in the university campus of computer classes with the necessary software and statistical packages; the readiness and desire of students of bachelor’s, specialist’s and master’s programs to study in the BF and DF formats; good academic achievements of students and their positive impression of the course in the BF or DF, etc. Given the students’ proposals for diversifying the forms of blended learning, such training can be organized very flexibly. We add that in the real educational process at MSUPE, both of these formats are successfully used in practice.

Conclusion

1. According to the results of a survey of the University students on the example of Moscow State University of Psychology and Education (N=761), the distance learning format (49.5%) and the blended format (lectures — in a distance format, seminars, practical classes — full-time) are the most preferable — 39.7%. The face-to-face format is the least in demand (10.8% of respondents). There were no differences between the respondents of these groups by sex and age. The age range in all three groups is almost the same — from 17—18 to 53—56 years.

2. In the group of students who prefer the blended learning format, compared to those who prefer the distance one, logical and verbal thinking is significantly better developed, indicators of natural science literacy are higher, the assessment of the benefits of COVID-19 vaccination for a person and society is higher, and the confidence in the serious negative consequences of the coronavirus vaccine is lower. In the group of students who chose the

face-to-face format, compared to the group who chose the distant format, the fear of COVID-19 was lower.

3. The combination of parameters of attitudes towards vaccination against COVID-19 and the intellectual sphere make it possible to distinguish two clusters of respondents. Cluster 1, compared to cluster 2, is characterized by higher rates of logical thinking, verbal intelligence, science literacy, better understanding of the benefits of COVID-19 vaccination for the individual and society, and less exposure to a variety of fears, doubts, underestimation of the dangers of COVID-19 and lack of confidence in vaccination.

4. In cluster 1, compared to cluster 2, the proportion of respondents who prefer the blended format of education predominates, and the proportion of those who prefer the distance format is smaller. The proportions of respondents who prefer full-time education are practically the same and make up only about 10% of the number in both clusters.

5. Four statistically significant predictors of respondents' choice of a blended or distance learning format were identified. The blended format is more likely to be preferred over the distant format for younger respondents with higher logical thinking scores,

less fear of COVID-19 disease, and greater confidence in the benefits of COVID-19 vaccination for the individual and society. The overall prediction accuracy of the model is 60.4%, which is higher than the probability of random guessing. Respondents have different opinions about what a blended format should be.

Restrictions

The limitation of the obtained results is the fact that the distributions in all three groups differ from the normal for almost all measured parameters (Kolmogorov-Smirnov test), with the exception of the NSL test ($p=0.097$), indicators on Scale 2 ($p=0.056$), Scale 3 ($p=0.075$) and Scale 5 ($p=0.083$) in the FTF group, as well as scores on Scale 1 in all three groups ($p=0.200$). Note, however, that the sample sizes of BF and DF are about 300 subjects, and with such large sample sizes it is rather difficult to obtain compliance with a normal distribution.

Directions for further research. The study of the prerequisites for students' acceptance of the digital educational environment and predictors of their choice of various learning formats, the inclusion of additional parameters in the model to obtain a more accurate forecast.

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