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Original articles

Quality of life and metamemory in higher education students during the COVID-19 pandemic

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ABSTRACT

Purpose: to analyze the quality of life and metamemory and verify their predictors in students during the COVID-19 pandemic.

Methods: a cross-sectional survey carried out through online collection with the application of an initial questionnaire to characterize the sample, the WHOQOL-brief to investigate the quality of life, and the Metamemory Questionnaire in Adults (short version) – MIAr to evaluate metamemory in a group of undergraduate and postgraduate students. Data were analyzed using descriptive and inferential statistics. Multiple linear regression was performed to verify the predictor variables. A significance level of 5% ($p \leq 0.05$) was considered.

Results: 977 university students participated in the study, the majority (70.73%) of whom were females and with an income range below three minimum wages (63.56%). For quality of life, income range, being in the risk group for COVID-19, and age were predictors for both the undergraduate and postgraduate groups. In contrast, on an excellent metamemory, the predictors were male gender and age.

Conclusion: for students, during the COVID-19 pandemic, the main predictor of quality of life was having a higher income bracket, and the main predictor of metamemory was being a male.

Keywords: Teaching; Pandemics; Students; Quality of Life; Metacognition

INTRODUCTION

In China, in December 2019, a new type of coronavirus was identified in patients with pneumonia. The virus spread worldwide, and in March 2020, the World Health Organization (WHO) declared the state a pandemic. This has led to changes in the routine and habits of the populations, globally, to adopt measures to reduce the spread of the COVID-19 virus, including wearing masks, avoiding agglomerations, not using essentials, and adopting hand hygiene measures[1]. Given this historical scenario, education also needed adaptations. In Brazil, remote classes were authorized during the pandemic[2]. Thus, the students' routine was modified, and emergency remote teaching (ERE) started to be adhered to by some institutions and universities to offer theoretical subjects.

However, obstacles and questions in this educational adjustment need to be discussed, such as access to the internet and the quality of learning for students who experienced the atypical challenges of this moment. The academic trajectory of university students and the professional future of graduates may also be affected by the measures resulting from the COVID-19 pandemic[3]. Among them, the lack of face-to-face contact during the study and physical and emotional exhaustion were identified[4].

Anxiety, stress, and negative emotions considerably increased among students during the pandemic[5]. Therefore, although the pandemic has already been overcome, this study can explain cognitive abilities, such as metamemory, recruited during an extreme situation and their relationship with Quality of Life (QoL), as these aspects can influence there.

QoL is a subjective concept related to well-being, health, relationships, and education[6,7]. Within the context of aspects related to QoL, one should also reflect on the transition of skills that encompass personal achievements and the elaboration of pedagogical values experienced by students[6].

In the educational dimension, metacognitive judgment is recruited throughout learning. Thus, the metacognitive skill, metamemory, which refers to knowledge about processes, monitoring, feelings, and self-efficacy for memory, contributes to the choice of cognitive resources[8,9]. It was established that metamemory assists learning, and understanding it can contribute to the identification of factors that cause academic difficulties in students[10]. However, research on this metacognitive ability tends to focus on individuals with neurological disorders[11]. This raises a need for student investigation, especially during a pandemic characterized by extraordinary educational changes.

Thus, understanding the effects of the COVID-19 pandemic, which profoundly changed the daily life of the population and the teaching-learning process in higher education, and its impact on quality of life and metamemory is necessary in the context of Brazil, given that the world may witness other alarming scenarios like this.

In the literature, there are still gaps about metamemory in students, especially during the pandemic period, and its relationship with quality of life. Therefore, this study contributed by determining the main predictors that directly or indirectly influence these aspects and expanding the research by considering the sociodemographic profile of students for the outcomes of both QoL and metacognitive function. Given the above, this research aimed at analyzing the quality of life and metamemory and verify its predictors in students, during the COVID-19 pandemic.

METHODS

Type of Study and Ethical Considerations

This is a cross-sectional, descriptive study of a quantitative nature. The research was approved by the Research Ethics Committee of the Federal University of Sergipe, SE, Brazil (CAAE 30580420.4.0000.5546; report number 4.311.766) and followed resolutions 466/12 and 510/16 of the National Research Council.

Population and Sample

Participants who adhered to the Free and Informed Consent Form, of any gender, aged between 18 and 59 years, residing in Brazil, and were enrolled in an undergraduate or graduate course at public or private higher education institutions were included in the study. They could be from any region of the country and any area of knowledge. Students from distance education (EAD) and lato sensu graduate courses were excluded. The students were divided into two groups: G1: undergraduate students and G2: stricto sensu graduate students (master's and doctorate).

The sample size calculation was performed using the formula: ((z^2×p(1-P))/e^2)/(1+((z^2×p(1-p)/(e^2 N)) where n = sample size, e = margin of error (5%), and z = z score (number of standard deviations between a given proportion and the mean).

The confidence interval was 95% and the minimum sample size was 385 for undergraduates and 383 for postgraduates.

Instruments

Participants answered a questionnaire developed by the authors, the World Health Organization Quality of Life Questionnaire - Bref Version (WHOQOL-bref) and the Metamemory Questionnaire in Adults (short version) - MIAr. The questionnaire developed by the authors consisted of questions about identification data, such as gender, marital status, and the region where they lived; information about the participants' Education for classification as an undergraduate or postgraduate student and area of knowledge; health information about being or living with someone in the risk group for COVID-19, in addition to socioeconomic data. Regarding income, the questionnaire included a question about whether or not family income had decreased during the pandemic and information about family income in four response alternatives and, for the logistic regression analysis, a cutoff point was stipulated (less than three salaries minimum wages and greater than three minimum wages) among the answer alternatives. Data were collected through closed questions with answer options selected virtually by the interviewees.

The WHOQOL-bref questionnaire, the abbreviated version of the WHOQOL-100, was applied to determine the quality of life. It consisted of 26 items. For each question, the participants were asked to answer from 1 to 5 on a Likert scale. The higher the score, the better the quality of life. WHOQOL-bref has four domains; the psychological refers to feelings, thoughts, concentration, and spirituality; the physical domain addresses issues such as physical health, activities of daily living, sleep, and work capabilities; that of the environment explores aspects of the home; finances, physical space and leisure moments; while social relations analyzes personal relationships, support and sexual activities[12]. A tool built by a group of authors was used to analyze this questionnaire, and the results were presented by domain and total score on a scale of 4 to 20 points[13].

Metamemory was investigated using the Adult Metamemory Questionnaire (short version) – MIAr, a short version of the Metamemory in Adulthood Questionnaire (MIA)[14]. The MIAr was adapted and translated into Portuguese[15] and contained 39 items referring to memory in everyday situations. The items have five alternatives on a Likert-type scale. The higher the score on the instrument, the better the metamemory. The results are divided into the following domains: strategy (knowledge and use of methods to improve memory), task (information about basic processes of memory functioning), capacity (the notion of memory capacities), change (perception of changes in memory over the years), anxiety (feeling of stress related to memorization), goals (awareness of the importance of good memory performance), control (knowledge about self-control in memorization skills), and total score. The strategy, task, and goals aspects belong to the "knowledge" factor; the ability, control, and change aspects comprise the "self-efficacy" factor, whereas anxiety is associated with both factors[14].

Procedures

Data collection

Between October and December 2020, data collection was conducted using the Google Forms platform. This period was brief to avoid the second wave of COVID-19 in the country, already announced by epidemiologists. The student had to access the link and answer it fully to participate in the research. Participants were recruited through digital dissemination through e-mails with information about the research sent to course coordinators, whose contacts were obtained through access to the websites of postgraduate programs and universities that provide e-mails from course coordinators, social networks, and communication media of Higher Education Institutions. To check the eligibility criteria, participants answered a list of questions.

Data analysis

Data were tabulated in spreadsheets in Microsoft Office Excel 2013. The results were analyzed using descriptive and inferential statistics with SPSS 25.0 software. Descriptive analysis of nominal qualitative variables was performed by measuring frequency and quantitative variables using central tendency, variability, and position measures.

The Shapiro-Wilk test was used to verify the quantitative variables' normality. To compare the quantitative variables in the ordinal qualitative function of two categories, the Independent T-Test was used for normal variables and the Mann-Whitney test for non-normal variables. Fisher's Exact Test and Pearson's Chi-Square were used to verify the association between qualitative

variables. Multiple linear regression was performed to confirm if the independent variables were predictors of the dependent variable. For this, the independent variables were dichotomized and transformed into dummies with a stepwise model adopting a statistical significance of 5% ($p \leq 0.05$).

RESULTS

A total of 977 university students participated in the research, 486 from G1 and 491 from G2. Most (70.73%) were females, with an average age of 28 years and one month, single (70.32%), and with an income below three minimum wages (63.56%). Most 78.30% of university students were not part of the risk group for COVID-19, 50.26% lived with people in the risk group, and the COVID-19 virus had not infected the majority (68.99%). Table 1 presents the sociodemographic profile and aspects related to the COVID-19 pandemic of students from G1 and G2.

Table 1. Association between sociodemographic profile and aspects related to the COVID-19 pandemic and students' schooling

		Schooling		p value
		G1 n (%)	G2 n (%)	
Gender	Female	346 (71.2%)	345 (70.3%)	0.779
	Male	140 (28.8%)	146 (29.7%)	
Marital status	Married	68 (14.0%)	194 (39.5%)	<0.001*
	Divorced	9 (1.9%)	18 (3.7%)	
	Single	408 (84.0%)	279 (56.8%)	
	Widowed	1 (0.2%)	0 (0.0%)	
Income bracket	<3 minimum wages	375 (77.2%)	246 (50.1%)	<0.001*
	>3 minimum wages	111 (22.8%)	245 (49.9%)	
Family income decreased during the pandemic	No	229 (47.1%)	288 (58.7%)	<0.001*
	Yes	257 (52.9%)	203 (41.3%)	
Part of the risk group for COVID-19	No	385 (79.2%)	380 (77.4%)	0.535
	Yes	101 (20.8%)	111 (22.6%)	
Lives with a member of the group at risk for COVID-19	No	209 (43.0%)	277 (56.4%)	<0.001*
	Yes	277 (57.0%)	214 (43.6%)	
Got infected with COVID-19	No	321 (66.0%)	353 (71.9%)	0.053
	Yes	165 (34.0%)	138 (28.1%)	
Postgraduate course	Master's degree	0 (0.0%)	272 (55.4%)	0.258
	Doctorate	0 (0.0%)	219 (44.6%)	
Area of the course you study	Biological sciences	39 (8.0%)	66 (13.4%)	<0.001*
	Exact sciences	84 (17.3%)	115 (23.4%)	
	Human sciences	123 (25.3%)	192 (39.1%)	
	Health Science	240 (49.4%)	118 (24.0%)	

Note. Fisher's Exact Test and Pearson's Chi-Square
Captions: n = absolute frequency; % = percent relative frequency; G1= undergraduate students; G2= stricto sensu graduate students.

In the WHOQOL-bref, G2 had higher scores in all investigated domains and the total score. Regarding MIAr, G1 had significantly higher scores than G2 in the "strategy" factor, and G2 had significantly higher scores than G1 in the "anxiety" factor, as shown in Table 2.

Table 2. Comparison of factor scores from the World Health Organization Quality of Life and MIAr questionnaires between G1 and G2

Variable	Schooling	Rate	SD	Minimum	Maximum	1Q	Mediana	3Q	t	p value
Physical	G1	13.89	2.61	5.14	20.00	12.00	13.71	16.00	-2.625	0.009*
	G2	14.33	2.60	4.57	19.43	12.57	14.86	16.00		
Psychological	G1	12.75	2.86	4.00	20.00	10.67	12.67	14.67	-3.285	0.001*
	G2	13.35	2.81	4.67	19.33	11.33	13.33	15.33		
Social relationships	G1	13.17	3.31	4.00	20.00	10.67	13.33	16.00	-2.383	0.017*
	G2	13.68	3.27	4.00	20.00	12.00	14.67	16.00		
Environment	G1	13.17	2.78	5.50	20.00	11.00	13.00	15.00	-6.694	<0.001*
	G2	14.27	2.34	6.50	20.00	13.00	14.50	16.00		
Self-evaluation from QoL	G1	14.17	3.12	6.00	20.00	12.00	14.00	16.00	-3.026	0.003*
	G2	14.77	3.09	4.00	20.00	12.00	16.00	16.00		
WHOQOL	G1	13.34	2.29	7.23	19.69	11.85	13.54	14.92	-4.910	<0.001*
	G2	14.04	2.15	6.77	19.08	12.62	14.31	15.69		
Strategy	G1	20.85	3.60	9.00	30.00	19.00	21.00	23.00	2.573	0.010*
	G2	20.27	3.46	10.00	30.00	18.00	20.00	23.00		
Task	G1	19.72	2.54	6.00	25.00	18.00	20.00	21.00	-0.030	0.976
	G2	19.73	2.54	11.00	25.00	18.00	20.00	21.00		
Capacity	G1	15.69	3.96	6.00	25.00	13.00	16.00	18.00	0.089	0.929
	G2	15.67	4.20	5.00	25.00	13.00	16.00	19.00		
Change	G1	11.99	4.06	4.00	20.00	9.00	12.00	15.00	1.537	0.125
	G2	11.59	4.13	4.00	20.00	8.00	12.00	15.00		
Anxiety	G1	14.28	4.45	5.00	25.00	11.00	14.00	18.00	-2.602	0.009*
	G2	15.03	4.59	5.00	25.00	11.00	15.00	19.00		
Goal	G1	33.50	3.66	20.00	40.00	31.00	34.00	36.00	0.170	0.865
	G2	33.46	3.66	21.00	40.00	31.00	34.00	36.00		
Control	G1	19.95	3.36	10.00	30.00	18.00	20.00	22.00	-0.471	0.637
	G2	20.05	3.15	10.00	30.00	18.00	20.00	22.00		
Total MIAr	G1	135.99	12.64	104.00	185.00	127.00	136.00	144.00	0.240	0.810
	G2	135.80	12.27	104.00	175.00	127.00	135.00	144.00		

Captions: WHOQOL= World Health Organization Quality of Life - Bref Version; MIAr =Questionnaire of Metamemory in Adults (short version); QoL = Quality of life; G1 = undergraduate students; G2 = graduate students; SD = standard deviation; 1Q = first quartile; 3Q = third quartile.

Multiple linear regression was performed to verify whether sociodemographic profile variables and aspects related to the COVID-19 pandemic could predict the result of the WHOQOL-bref and MIAr questionnaires (Table 3).

Table 3. Analysis of sociodemographic profile variables and aspects related to the COVID-19 pandemic predictive of the results of the World Health Organization Quality Of Life questionnaire and the MIAr questionnaire in G1 and G2 students

Model	Coefficients not standardized		Coefficients standardized	t	p value	VIF
	B	Error Error	Beta			
WHOQOL						
G1						
(Constant)	14.729	0.417	-	35.306	0.000	-
Income bracket	1.702	0.230	0.313	7.397	0.000	1.006
Age	-0.065	0.017	-0.165	-3.882	0.000	1.022
Part of the risk group for COVID-19	-0.641	0.239	-0.114	-2.679	0.008	1.015
Course in Biology	-0.897	0.357	-0.107	-2.514	0.012	1.012
G2						
(Constant)	12.632	0.415	-	30.459	0.000	-
Income bracket	0.822	0.208	0.191	3.956	0.000	1.371
Course in Health	0.912	0.210	0.181	4.337	0.000	1.027
Gender	0.683	0.196	0.145	3.482	0.001	1.020
Family income decreased during the pandemic	-0.587	0.184	-0.134	-3.190	0.002	1.042
Got infected with COVID-19	-0.562	0.199	-0.117	-2.826	0.005	1.015
Part of the risk group for COVID-19	-0.709	0.214	-0.138	-3.310	0.001	1.020
Age	0.035	0.013	0.126	2.643	0.008	1.331
MIAr						
G1						
(Constant)	141.014	2.444	-	57.700	0.000	-
Gender	6.216	1.221	0.223	5.089	0.000	1.004
Age	-0.284	0.096	-0.130	-2.949	0.003	1.013
Income bracket	3.511	1.318	0.117	2.664	0.008	1.005
Got infected with COVID-19	-2.399	1.171	-0.090	-2.048	0.041	1.009
G2						
(Constant)	128.810	1.196	-	53.519	0.000	-
Gender	3.897	1.196	0.145	3.259	0.001	1.002
Age	0.181	0.071	0.113	2.534	0.012	1.002

Captions: VIF = Variance Inflation Factor; WHOQOL= World Health Organization Quality of Life - Bref Version; MIAr =Questionnaire of Metamemory in Adults (short version); G1 = undergraduate students; G2 = graduate students

DISCUSSION

The present study aimed to analyze the quality of life and metamemory and verify their predictors in students during the COVID-19 pandemic. Regarding the sociodemographic profile of the students in the present study, older age is expected in G2, which may be related to and justify marital status, because most are married.

The per capita income range of up to one and a half minimum wages was the most prevalent among graduates. This can be attributed to the fact that, even when they have their income, young people who live with their parents and are economically dependent on their family play a complementary role in financing the costs associated with their stay on the course[16], unlike postgraduate students who are professionals who are more satisfied with their jobs and income after completing postgraduate studies[17].

In this research, most of G2 in this study did not reduce their income during the pandemic and generally had higher means of income. In contrast, the financial situation of G1 was even affected by the pandemic, suggesting that it is a population with greater social vulnerability than G2, which confirms that schooling is related to income[18].

The WHO categorized groups considered at risk for COVID-19 as health workers, people aged 60 years and over, and people with comorbidities such as chronic noncommunicable diseases (NCDs) and immunosuppression[19]. G1 participants must live with people from one of these risk groups, because even those living in another city to study returned to their parents' houses due to the ERE. Living with parents or grandparents can justify this because CNCDs are more prevalent in this population.

There was greater voluntary participation of students from G1 in the health course, while from G2, there was greater participation from students in the biological course. The difficulty of obtaining a proportional sample from different areas of knowledge may have been a limitation of the study, however, it did not affect the inferential statistical analyses, as it presented, in each subgroup, a sufficient number of participants for the statistical tests to be carried out. Another weakness of the research is related to multi or interdisciplinary postgraduate programs, which were not categorized in the sample.

Regarding the comparison between the groups, in terms of quality of life, it was observed that, in all domains, there was a statistically significant difference, with a worse score in G1. Quality of life is known to be related to income[20]. In the present study, G1 had a lower income when compared to G2, which may explain the lower average quality of life among undergraduates. In addition, another study found that during the pandemic, stress was higher in subjects with lower incomes and young adults[21]. The environment domain was the one with the greatest difference between the groups. It refers to the physical environment, financial resources, leisure, transport, and safety[12], factors also associated with socioeconomic conditions. This data corroborates the income aspect, which is also significantly discrepant between the groups, with G1 being more economically vulnerable.

In metamemory, there was a statistically significant difference with a higher average for the strategy subscale in G1. This aspect refers to the knowledge and use of strategies for memory[14]. The subjects of G1, because they are younger, may have a better perception and awareness of the use of this skill. However, further studies are needed because there is still no research comparing these groups.

In the MIAr Anxiety subscale, there was a higher mean in G2, with a statistically significant difference between the groups. Master's and Ph.D. students have high demands. They often need to present seminars, which can put them in a situation of memory anxiety in project presentations and scientific article debates, which are circumstances that may justify their higher subjective perception of memory anxiety compared to undergraduates.

Considering predictors for quality of life, both in G1 and G2, income range, age, and being part of the risk group for COVID-19 were predictors of QoL. Furthermore, for G1, taking biological courses was also predictive. In G2, the model also indicated studying health courses, gender, income that decreased during the pandemic, and having been infected with COVID-19.

As demonstrated in the study's results on the influence of low income on worse quality of life, other research also identified low economic status as a predictive factor for worse QoL[22]. The decrease in income during the pandemic also negatively influenced QoL, and this reflects how much the financial situation is related to QoL. These two findings together strengthen the discussion regarding this association.

Furthermore, it is worth noting that the pandemic interfered with the economy; people lost their jobs, non-essential services were suspended, and informal workers lost their income, which, consequently, reduced the income of part of the population. This was reflected in G2, which is part of the economically active population. Being older in G1 predicts a worse quality of life. Younger students demonstrate better chances of good educational results[23]. This can generate frustration and negative feelings in older people and interfere with their QoL. In G2, being older predicts better QoL, which can be justified by the fact that, as the years of study go by, those with older age and professional training may be more satisfied.

Being part of the risk group for COVID-19 was a predictive factor for worse QoL regardless of the group. A study in Israel revealed that belonging to the risk group was positively associated with fear of COVID-19, which resulted in stress, depression, and anxiety[24].

Studying biological sciences suggests a worse QoL in G1, which can be justified by the fact that people in this area are also involved in the development of therapeutic resources to face the pandemic[25]. Thus, this may have generated work overloads that impacted the quality of life of these individuals. Meanwhile, in G2, being enrolled in a health course predicts better QoL. It is believed that health students have more understanding regarding health care since their academic

curriculum offers disciplines and practices in this aspect.

Infection with the COVID-19 virus was also a predictor of worse QoL in G2. People infected by the virus experienced various health damages, such as changes in cardiovascular health[26], neurological disorders[27], and changes in the olfactory and gustatory sensory systems[28]. These people also experienced moments of isolation and worries about death. These factors can influence QoL as they relate to physical and emotional health. Research is still being carried out in order to reach a definitive conslusion.

Being a female was also negatively related to QoL in G2. In a study with students, women showed a high co-occurrence of risk factors for health[29], which can negatively impact the quality of life.

Regarding metamemory, in both groups, gender and age were predictors. For G1, income range and having been infected with COVID-19 were also predictors. Being a male was a predictor of better metamemory in both groups. One study showed that being a male favored knowledge and control of planning and the metacognitive process[30].

In G1 and G2, age was a predictor for MIAr. In G1, older age suggests worse metamemory, while in G2, older age suggests better metamemory. In G2, students already have more years of schooling and more experience with learning processes, which can help with the perceptions of metamemory, that is, what involves recording, storing, and retrieving memory[31].

Being infected with the COVID-19 virus predicited worse metamemory in G1. The infection that causes COVID-19 has the potential to provoke a cytokine storm, an immune response that causes more harm than immediate benefits, and can induce physiological changes and tissue and the nervous system damage[32]. Furthermore, treatment for COVID-19 can damage cognition[33]. However, it is not yet known whether the results may be due to direct or indirect sequelae of the infection, and there is currently no way to discuss this finding in the light of the literature.

It stands out regarding the influence of the income variable on self-perception of metacognition observed in both G1 and G2. A 2017 study suggested that socio-economic status is associated with aspects of brain structure, however the results are not fully generalizable, raising the discussion regarding the influence of these findings on academic performance and well-being[34]. The limitations of this study may be related to the fact that information about disabilities, intellectual deficits or underlying psychological distress and use of controlled medications were not investigated in the initial identification questionnaire.

Importantly, the results of this research are generalizable to undergraduate and graduate students in Brazil. In this study, the most vulnerable population was female and low-income. In the current literature scenario, the research demonstrates advances in the investigation of the cognitive ability of metamemory in higher education students, as it is still little explored, but it can help to understand the personal and social aspects that influence memory self-monitoring. Furthermore, the study highlights the main outcomes so that future research can investigate in the long term.

CONCLUSION

G2 students had a better quality of life compared to G1. The income range proved to be the main predictor of quality of life, regardless of the group. There was a significant difference between the groups in the MIAr subscales, G1 with the best strategy for memorization and G2 with more perception of anxiety for memorization. Being a male was a predictor of better performance in metamemory, regardless of the group studied. In G1, the predictor variables were age, gender, income range, and COVID-19 infection, and in G2, gender and age.

The study demonstrated how much, above all, the economic factor and gender associated with the pandemic and change in pedagogical strategy can negatively influence the quality of life and metamemory of the analyzed students.

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