Measuring Students' Cognitive Engagement During Emergency Online Learning in the Amidst of COVID-19 Pandemic

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The aim of the study was to measure the students' cognitive engagement by considering their motivational drives during the remote learning process because of COVID-19 pandemic. Stipulated this, the study employed Biggs's (1987) Study Process Questionnaire to measure students' cognitive engagement enrolled in the public and private universities by offering them online learning facility. Statistically significant results were witnessed for the demographic variables (gender, university type, discipline, and prior online experience) in relation to students' cognitive engagement. Stepwise regression analysis predicted cognitive engagement of social sciences' students' through surface approach and surface strategy for the postgraduate students. Furthermore, it also estimated that students' with earlier experience of online learning predicted more profound (deep) motive drive and female students' projected more deep strategy as compared to their male counterparts. This study presents implications to the teachers to employ useful online teaching strategies to engage students' remotely and to organize their teaching sessions according to the needs of the learners.

Keywords. Cognitive engagement, motivation, strategies, surface, deep, pandemic

Teaching and learning process has transformed from physical setting to virtual modes as a result of COVID-19 pandemic, especially the suspension of all in-person activities invited the call to transform education system in the Pakistan (Thomas, 2022). This substantial change has originated the revolution in the teaching and learning for students' and teachers to accept this challenge to successfully obtain the

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high-quality learning outcomes in virtual settings. Since pandemic challenges have impacted on the delivery of education that has introduced the two significant modes of learning for instance, synchronous and asynchronous in Pakistan (Shaukat et al., 2022). These two modes of education include face to face and online teaching process.

The characteristics of good teaching supersede in online teaching when compared with face to face teaching and learning. Online teaching allows learners to participate simultaneously during lecture in the group form. In such type of a group activity, several views are shared due to the available online learning features. Online teaching is becoming more popular in the post pandemic situation because of only this accessible opportunity (Kew & Tasir, 2021). The nature of the teaching tasks has been reformed during the virtual teaching and learning process for instance, students' do not need to commute to attend the classes and they can participate in the teaching and learning process at distance.

On the other hand, engaging students' during online learning has been a great challenge so far (Pedler et al., 2020). Teachers utilize many different online resources to engage students' to make difference in their learning. The efforts made by teachers for delivering online lectures do not confine to the class time only instead teachers consume more time to prepare and record the lecture prior classes. In order to make use of material/content meaningfully, they use mixture of teaching strategies including lecturing, questioning, group discussions, and feedback.

Pakistan being an emerging developing country where online learning is relatively a new phenomenon for the universities to execute the remote teaching sessions due to the compromising physical structure of the online teaching broadcast system (UNDP, 2020). Considering the same scenario, this research agenda is a key issue of research in the national context where less research is found on the apprehensions relevant to how to keep learners engaged during the online teaching and learning process? How to ensure their responsive participation during online teaching? And whether it is the shared responsibility of teachers, learners or of the system at large? This transformational trend of teaching from physical classes to online teaching has been found sensitive to all the levels of education where a school going child to a university undergraduate student has dealt with it (UNESCO, 2020). Since this study is the baseline research in Pakistan to measure the impact of demographic information in relation to students' cognitive engagement thus this study will contribute new knowledge in the related research.

The spectrum of research has focused on the issues of online system of education with varied aspects for instance, study of increasing interest

of students' through teaching strategies, exploring experiences of students' during online learning (Yan et al., 2021), challenges and suggestions regarding effectiveness of online learning (Heng & Sol, 2021; Hermanto & Srimulyani, 2021) and studies regarding the evaluation of online learning system at different levels (Danchikov et al., 2021).There is limited evidence of research regarding students' problems of online learning and particularly measuring students' cognitive engagement during online learning in the context of Pakistan. Hence the current study is intending to measure cognitive engagement of university students' who were exposed online teaching first time in their academic career due to the COVID-19 pandemic.

The construct of students' cognitive engagement can be defined as the degree to which students' approach towards content to process in their minds regardless of having varied learning experiences and motivations (Spanjers, 2007). Explicitly it means that gaining marks does not become a priority to explore rather the pattern of using brain towards learning by utilizing the motivations and learning strategies. Cognitive engagement is the way students' make sense of the content and timely process the information (Kigundu, 2014). It is explained as the effort or energy exerting by the students' to grasp the taught ideas completely as well as to absorb the meaning of content with proper context (Blumenfeld et al., 2006).

Students' engagement is a multi-dimensional construct (Veiga et al., 2014). It is divided into some more dimensions or levels where consensus does not exist. Physical, behavioral, cognitive, and emotional etc. are the stated types of students' cognitive engagement (Sinatra et al., 2015). Each dimension of cognitive development plays a pivotal role when overall performance of students' is a serious subject of interest. This study emphasizing the pertinent dimension of cognitive engagement that is concerned to observe the motivational derives of students' learning. Cognitive engagement has two dominant learning approaches of students' i.e. motive and strategy. These two approaches have further three distinct levels that help defining the intellectual input of the learners while using their brains (Blumenfeld et al., 2006). Surface Motive (SM) defines the least level of input that keeps one away from failing the task. Surface Strategy (SS) explains the surface strategy is bound to produce the task by exercising memorized knowledge. Deep Motive (DM) slightly ahead from SM, it adds the self-involvement to better perform in a specified area or subject. Deep Strategy (DS) is alike SS, it is practical and had a step ahead by relevant readings and exercising prior knowledge.

Nobody can deny the fact that availability of appropriate facilities is helpful in the smooth learning (Pedler et al., 2020), however for the

complex learning concepts, the intellectual involvement of learners has the significant importance (Amiryousefi et al., 2019). This evidence is aligned with the research findings of (Blumenfeld et al., 2006) who reported that motivation and teaching strategies work together to accelerate cognitive engagement of students, where better learning environment remains a useful component to keep students engaged mentally and physically. In a recent study conducted by the Chiu et al., (2022) to examine the status of students' online learning engagement in relation to self-determination theory that theory explains varied degrees of students' involvement during teaching and ultimately it relates to the components of cognitive engagement of learners. It was suggested to keep students engaged through online learning that help them remain in-touch. Since online learning is a prerequisite of continuing education, it assists not to break the sequence of education during COVID-19 Pandemic.

Another research conducted by Kew and Tasir (2021) that entails a mile into the content analysis of students' discussion of students' experiences of online teaching. This study reported the substantial quotations of the students' intellectual engagement as a result of online learning by considering students' gender. Mainly students shared their experiences of remote learning experiences with a very little emphasis on their intellectual development. According to students' discussions, they talked more on the required teaching materials and tools for their better understanding.

In another research study, the teacher's role was highlighted for the students' intellectual development and responsive attitude in the classroom. In this study, it was professed that teachers contributed a significant role in relation to students' active engagement. Teachers utilized the package of ICT strategies including games, videos, simulations (Pedler et al., 2020). Students' learning engagement addresses the different teaching requirements when it comes to the online classrooms that is completely different from face-to-face classes regarding the usage of learning resources such as audio, video, learning materials, and virtual blackboard. The major difference is communication between teachers and learners that is said to be taken as classroom participation.

During online learning, a teacher can directly observe the behavioral engagement of students whereas emotional and cognitive engagement comes at the end for observation. Similarly, behavioral engagement is considered as simple and emotional and cognitive engagements are complex in the scenario of online learning specifically. While students are on distance, teachers face difficulty in assessing the mental involvement of students, although the efforts of

students are visible through their regulation of perception, responses, and cognition (Hu & Li, 2017). Hence, teacher's role becomes more responsible to dealt with students' cognitive development by engaging them promising cognitive acceleration tasks.

Teachers tend to use active channels for communication that does not only enhance their teaching but also the ways they keep their students active, responsive, and motivated. It has a positive impact on students' performance (Kulkarni et al., 2018). A detailed description and definition of the construct under study i.e., students' cognitive engagement was reported in this study regarding the teachers' positive influence in the students' learning process. The learning process is sensitive in so many ways like how teachers can impact as well as the degree to which students are fully involved in the process of learning by using their intellect and cognition (Sesmiyanti, 2016). The theory of cognitive engagement emphasizes the fact that all the students do not work on temporary basis or surface level instead they understand the information from base to application level. Certain levels are well-reported in the theoretical framework of students' cognitive engagement. This comprehensive theory figured out how likely students to participate in academic tasks or learning by keeping their minds actively involved (Blumenfeld et al., 2006).

Rationale of the Study

This study spotlights by considering the contextual background of Pakistani students who were exposed to online learning first time without providing them sufficient guidance to utilize the online learning resources, this study intends to measure students' cognitive engagement during their online learning process through synchronous and asynchronous teaching techniques. This study provides the practical component of learning while noticing the cognitive engagement of students during virtual setting (Barlow et al., 2020). It is further highlighted that the construct of cognitive engagement is equally significant while studying science subjects as it is important in social sciences. Different students' styles to learning and motivation level of cognitive engagement were used in the instrument to determine the Pakistani student's cognitive engagement during the transition phase of virtual modes of teaching.

The objectives of the present study were to determine the impact of demographic variables (gender, discipline, education, university type, and online teaching) on students' cognitive engagement during online learning amid of COVID-19 pandemic. Students cognitive engagement positively relate with (surface motive, surface strategy, deep motive, deep strategy).

Method

Sample

Using a cross-sectional design, a total of 395 students were from two large universities of a metropolitan city of Pakistan followed by convenient sampling approach participated in this research. Most respondents belonged to a public university ($n = 231$) while some students ($n = 164$) were from a private university; both groups of students were enrolled in online learning focused courses. Of the participants, there were more female students ($n = 209$) as compared to male students ($n = 186$). The other demographic variables regarding subject discipline majority students enrolled in science program ($n = 231$) and others were enrolled in social sciences ($n = 164$). Including students aged 62% were less than 20 years old whereas 23% were above 20 years old. On the variable of online learning experience of students, 63.3% already had online learning experience while 36.7% had no experience at all. Regarding students' education level, large number of respondents ($n = 257$) were undergraduate students while there were only ($n = 138$) postgraduate students who participated in this study.

Measures

Demographic Sheet

A demographic sheet was designed to gain explicit information (including gender, educational level, university type, online learning experience, age and discipline) of the respondents.

Study Process Questionnaire

The instrument employed in this research study contained two separate parts that is participant demographics information and the Study Process Questionnaire (SPQ; Bigg, 1987), which determines students' styles to learning and motivation level. SPQ questionnaire consists of four subscales, *surface motive* relates with the concept of rote learning; *deep approach* relates to internal motivation; whereas *deep approach* involves the process of a higher cognitive level than rote learning for instance searching for analogies and *achieving strategy* involves a high level of effort to learn the concept. The shorter version of SPQ comprises of 20 items and encompasses 4 subscales (with five items each), ranging from (1 = below average, 2 = average, 3 = above average). All data were collected through an

electronic survey in 2021. Reliability for the SPQ has been recognized through some studies (Fox et al., 2001; Richardson & Newby, 2006; Zeegers, 2002). Overall Cronbach Alpha for the study was reported .87 that is considered good reliability (Cresswell, 2000). Whereas reliability coefficients were labeled as Surface Motive (.61), Surface Strategy (.61), Deep Motive (.61), Deep Strategy (.75), Achieving Motive (.72), and Achieving Strategy (.65).

Results

Regression analysis

Stepwise regression analysis was used to explore the predictors of cognitive engagement through a surface approach, demographic variables (gender, university type, age, education, online teaching, discipline) were taken as predictors. Only significant models are reported in Table 1.

Table 1

Stepwise Regression Analysis for Predictors of Surface Approach of Students Cognitive Engagement

Predictors	B	β	R_2	ΔR^2	F	95% CI	
						LL	UL
Step 1							
Constant	13.78		.12	.12	54.84**	12.26	15.30
Education	-.34	.35**				2.96	5.09
Step 2							
Constant	15.89		.14	.02	32.15**	13.82	17.97
Education	-.31	.35**				2.96	5.08
Online Teaching	.41	-.14*				-2.61	-.50
Step 3							
Constant	19.20		.15	.02	24.80**	16.20	22.20
Education		.31**				2.43	4.63
Online Teaching		-.14*				-2.68	-.59
Discipline		-.14*				-2.66	-.54

Note. Education: 1 = Undergraduate, 2 = Postgraduate; Online Training: 1 = Yes, 2 = No; Discipline: 1 = Social Sciences, 2 = Sciences.

**$p < .001$, *$p < .01$.

According to the results (Table 1) Step 1 shows 12% variance that is caused by education in surface strategy. B-value is positive which shows that as education increases from undergraduate to postgraduate, the surface approach in learning tends to increase. Step 2 shows a 14% cumulative variance of education and online teaching

experience in surface strategy. The unique variance of online teaching experience is 2%. This means with prior online teaching exposure, the surface approach to learning also increases. Step 3 shows a 15% cumulative variance of education, online teaching experience, and discipline in surface strategy. Unique variance is 2% of discipline in surface strategy that predicts the more students belong to social sciences discipline the more surface approach enhances as a component of cognitive engagement. Gender and university type are excluded for having nonsignificant role in surface motive.

To explore the predictors of cognitive engagement through surface strategy, demographic variables (gender, university type, age, education, online teaching, and discipline) were taken as predictors in stepwise regression analysis. Only significant models are reported.

Table 2

Stepwise Regression Analysis for Predictors of Surface Strategy of Students Cognitive Engagement

Predictors	B	β	R^2	ΔR^2	F	95% CI LL	95% CI UL
Step 1							
Constant	19.65		.02	.02	8.68**	17.93	21.38
Gender	-.1.61	-.15**				-2.69	-.54
Step 2							
Constant	17.98		.03	.01	6.60**	15.65	20.30
Gender	-1.58	-.15**				-2.65	-.51
Education level	1.21	.11*				.082	2.34

Note. Education: 1 = Male, 2 = Female; Education Level: 1 = Undergraduate, 2 = Postgraduate.

**$p < .001$, *$p < .01$.

According to the results (Table 2), Step 1 shows a 2% variance that is caused by gender in surface strategy. Negative B-value shows being male student employ more surface strategy as a mode of cognitive engagement in learning. Step 2 shows 3% cumulative variance of gender and education level in surface strategy. The unique variance of online teaching experience is 1%. B-value shows as education level increases from undergraduate to postgraduate, surface strategy is employed more in learning. University type, prior online learning experience, and disciple are excluded for having nonsignificant role in surface strategy.

To explore the predictors of cognitive engagement through deep motive, demographic variables (gender, university type, age,

education, online teaching, and discipline) were taken as predictors. Only significant models are reported in Table 3.

Table 3

Stepwise Regression Analysis for Predictors of Deep Motive of Students Cognitive Engagement

Predictors	B	B	R^2	Δ R^2	F	95% CI LL	UL
Step 1							
Constant	23.35		.03	.03	12.19**	20.15	24.54
Discipline	-2.36	-.17**				-3.68	-1.03
Step 2							
Constant	25.59		.05	.02	10.71**	22.55	28.63
Discipline	-2.61	-.19***				-3.33	-.69
University type	-2.01	-.15**				-3.33	-.69
Step 3							
Constant	23.43		.07	.02	9.00**	19.89	26.97
Discipline	-2.81	-.21***				-4.14	-1.49
University Type	-1.91	-.14**				.23	2.83
Gender	1.53	.16*					
Step 4							
Constant	25.59		.08	.01	8.05**	21.58	29.59
Discipline	-2.89	-.21***				-4.21	-1.56
University type	-1.89	-.14**				-3.20	-.58
Gender	1.52	.11*				-2.86	-.17
Online teaching experience	-1.51	-.11*					

Note. Discipline: 1 = Social Sciences, 2 = Sciences; University type: 1 = Public, 2 = Private; Gender: 1 = Male, 2 = Female; Online teaching experience: 1 = Yes, 2 = No.
***$p < .001$, **$p < .001$, *$p < .01$.

According to the results (Table 3) Step 1 shows 3% variance that is caused by discipline in deep motive. B-value shows a negative value that predicts for students enrolled in the social sciences discipline for having more deep motive as cognitive engagement. Step 2 shows added 2% of university type in deep motive. Being student at the public university means having deep motive in cognitive engagement. Step 3 shows 1% variance that is caused by gender in deep motive, positive B-value depicts that female students have a deep motive for learning. Step 4 shows 8% cumulative variance of discipline, university type, gender, and online teaching experience in deep motive. Unique variance is 1% for prior online teaching experience, students who have prior experience of online teaching

sustain a deep motive of cognitive engagement more. Education level is excluded for having nonsignificant role in deep motive.

Stepwise regression analysis was employed to explore the predictors of cognitive engagement through deep strategy and demographic variables (gender, university type, age, education, online teaching, and discipline) were taken as predictors. Only significant models are reported in Table 4.

Table 4

Stepwise Regression Analysis for Predictors of Deep Strategy of Students Cognitive Engagement

Predictors	B	β	R^2	ΔR^2	F	95% CI LL	UL
Step 1							
Constant	21.64		.02	.02	9.23**	19.84	23.44
University type	-1.86	-.51**				-3.06	-.66
Step 2							
Constant	18.10		.04	.02	8.25**	16.34	21.63
University type	-1.72	-.14**				-2.92	-.52
Gender	1.60	.13**				.42	2.78

Note. University type: 1 = Public, 2 = Private; Gender: 1 = Male, 2 = Female.

**$p < .001$, *$p < .01$.

According to the results (Table 4), Step 1 shows 2% variance that is explained by university type in deep strategy. Negative B-value shows students enrolled in the public university utilize deep strategy for learning. Step 2 shows 4% cumulative variance of university type and gender in deep strategy. The unique variance of gender is 2%. B-value has positive value that shows female students employ deep strategy in learning. Prior online learning experience, discipline, and education level are excluded for having nonsignificant role in employing deep strategy as the mode of cognitive engagement in learning.

An independent sample t-test was performed to analyze the results along gender, university type, discipline, online teaching experience, education level and age groups. Significant mean score difference was found between male and female students' surface strategy and deep strategy of cognitive engagement. Male students have higher level of surface strategy to learn the lesson concepts online as compared with female counterparts with small effect size concluded by Cohen's eta squared statistics (0.3). On the Deep Strategy Subscale, female students show more deep strategy for online

learning than male students with small effect size reported by Cohen's eta squared statistics (0.3).

Another significant mean score difference was found between students of social sciences and sciences discipline on the two subscales of surface motive and deep motive of cognitive engagement. Students from social sciences discipline had higher level of surface motive for online learning as compared with science students with medium effect size concluded by Cohen's eta squared statistics (0.5). Likewise, on the deep motive subscale, social sciences students revealed more deep motive for online learning than sciences students that exposed small effect size reported by Cohen's eta squared statistics (0.4).

Likewise, significant mean score difference was found between students' with and without online learning experience on the two subscales of surface motive and deep motive of cognitive engagement. Students with prior online learning experience had higher level of surface motive for online learning engagement than students without online learning experience with small effect size concluded by Cohen's eta squared statistics (0.3). Likewise, on the deep motive subscale, students with prior online learning experience showed more deep motive for online learning engagement than students without online learning experience that exposed small effect size reported by Cohen's eta squared statistics (0.2).

On the variable of university type that indicates significant mean score difference between public and private university students' cognitive engagement for online learning experience on the two subscales of deep motive and deep strategy. Students from public universities had higher level of deep motive for online learning than students from private universities with small effect size concluded by Cohen's eta squared statistics (0.3). Likewise, on the deep motive subscale, public sector students held more deep motive for online learning than private sector students that exposed small effect size reported by Cohen's eta squared statistics (0.3).

In addition, a statistically significant mean score difference was found between postgraduate and undergraduate students' cognitive engagement for online learning experience on the three subscales of surface motive, deep motive and deep strategy. Postgraduate students had higher level of surface motive for online learning than undergraduate students with large effect size concluded by Cohen's eta squared statistics (0.3). Similarly, on the surface strategy subscale, postgraduate students held more surface strategy for online learning than undergraduate students that exposed small effect size reported by Cohens' eta squared statistics (0.3). Postgraduate students held more

deep motive for online learning than undergraduate students that showed small effect size reported by Cohen's eta squared statistics (0.3).

Discussion

This study investigates measuring the cognitive engagement of students' while teaching remotely during the pandemic. This study is the baseline research for providing the implications to strengthen the online teaching structures for teaching students academically responsive students (Amiryousefi et al., 2019; Sesmiyanti, 2016).

This study presents the findings by predicting the relationship between students' cognitive engagement and demographic variables. This study predicts that students enrolled in the social sciences discipline showed more cognitive engagement through surface approach through online teaching. This finding reveals that students were concentrating more on the conceptual information followed by surface approach for the social sciences discipline. This could be due to the limitation of the online teaching that was more likely to address the lesson concepts through lecturing and practical work was missing due to the online setting (Amiryousefi et al., 2019). It predicts the students' cognitive engagement through surface strategy in online teaching. This finding reveals that students showed more inclination towards reproducing the material through rote learning followed by surface strategy between undergraduate and postgraduate level. It could be because in higher level of learning (postgraduate), students put more effort in reproducing the content (surface strategy) than at graduate level (Sesmiyanti, 2016).

According to another finding, the predictors of cognitive engagement were explored through deep motive. It showed that developing competence in specific academic subjects (Deep Motive) was found more among students with having prior online teaching experience. Further it revealed that female students had a deep motive for learning it could be because the students with prior online learning experience know better ways of performance in online learning settings (Sesmiyanti, 2016).

The study findings predict cognitive engagement among students through deep strategy and demographic variables primarily university type and gender. In order to interrelate with prior relevant knowledge and discovering meaning by extensive reading (Deep Strategy) was more found in public as well as among female students. It could be due to the emphasis and regular check and balance in public sector universities that students showed deep strategy.

This study also provides a clear picture about the importance of cognitive engagement of students by investigating the differences of students' cognitive engagement in relation to demographic variables. According to the findings of current study, one pertinent result showed gender wise mean difference between male and female students regarding components of cognitive engagement. It would be right to report here that male students displayed more score in surface strategy (SS) meaning that boys had more tendencies to reproduce the learnt material/content than the girls. On the other hand, girls showed more deep strategy (DS) than boys. It means girls were found with more practical knowledge to relate earlier information with existing knowledge. It is due to the likely emphasis on male students to work hard for showing better performance whether learning the material without understanding. Similarly, girls try to engage in learning by keeping their existing knowledge active to better scaffold the new information. It implies to make students equally busy while teaching regardless of their gender (Sesmiyanti, 2016).

Another significant finding was about mean difference of discipline across components of cognitive engagement. It was shown that social sciences students had more tendencies to fulfill the requirement of work (surface motive) than science students. It is likely due to the nature of disciplines that put social sciences students to only know the situation without that's practical component or relating similar situations. In the same way, social science students had high deep motive (DM) that they tend to perform in specific subject better than science students. It may happen because of the theory of social science that allows learner to understand events beyond different circumstances. It implies that teachers should relate practical examples while teaching theoretical knowledge so the science and social science students can easily generalize or relate the concepts (Barlow et al., 2020).

An interesting feature of cognitive engagement was highlighted with comparison of students with having prior online learning experience and no online learning experience earlier. It was found that learning ability of already having online learning experienced students was better than the no orientation of learning experience. It is likely due to their experience to know before performing the least expected requirement of the tasks. Consequently, the Deep Motive (DM) component was higher in online learning-oriented students than other students without online learning experience. It means that prior online learning experiences student has more inner involvement to perform in the specific area. It is likely to understand that having online

learning experience proved better results that online learning was not new to them (Pedler et al., 2020).

Public sector students showed more inner involvement for good performance in specific subject (DM) than the private sector students. It may happen because the public sector students must go through more check and balance resultantly, they show better performance than private sector students. Similarly, public sector students showed relating their previous knowledge with the help of extensive reading (deep strategy) (DS) than private sector students. It is a general understanding that pattern of public sector students keeps students on performing up-to the set standards by hard work. Private sector students may face flexible ways to work on individual pace. These sector wise findings imply that uniformity of education must be implemented for putting students' efforts on equal grounds or criterion (Pedler et al., 2020).

When compared postgraduate and undergraduate students on sub-scales of cognitive engagement, post graduate students displayed significant difference of mean on surface motive, surface strategy, and deep motive. It is the way that post graduate students make continuous efforts to complete the tasks (SM), excel in specialized subject by putting maximum inner involvement (DM), as well as perform well on the base of memorized information (SS). Post graduate students know the formative system of education more profoundly than the beginners. It means that post graduate students had more cognitive engagement than their counterparts. Post graduate students spend more time in university and become aware of the system more than undergraduate students. It implies that the undergraduate students can learn their practices (whether physical or online learning) from senior students to become active learners.

Limitations

The present study may have some limitations such as while, interpreting the results of this study a number of limitations should be taken into deliberations. Primarily, the sample of current study was based on diverse university students; therefore the results may have been subjective by the characteristics of these educational institutes. To minimize this limitation, it is necessary that sample must be taken from distinctive facets of life to measure the concrete adaptability. In addition, this study measured the cognitive engagement through self-report measures so common method-bias should be cogitated. Moreover, because of small-scale sample, collection of data through online communication means and employing cross-sectional survey

design can be a limitation of generalizability of data in different settings. This limitation could be castigated consuming other more efficient methods of data collection and by increasing the sample size including individuals from different regions of Pakistan signifying distinctive cultural and ethnic groups. In addition, data were collected on achieving strategy (AS) and achieving motive (AM) and that contributed to the Mean and SD overall, but both of these subcomponents of cognitive engagement were not put in analysis because of the structure of studies at national level that focuses primarily on the completion of basic tasks. Those can be achieved by memorization of information or facts. Evaluation is mostly subject to the surface level i.e., reproduction of the material relying on the memory component of students' intellect.

Conclusion

Since pandemic has changed the scenario of teaching and learning process, so it is imperative to implement the online distance learning policy in the higher education institutions according to the needs of the learners by addressing and accelerating students' cognitive engagement. Subsequently, this study also emphasized to include the hands-on learning activities in order to reinforce students' deep motive and deep strategy learning approach in all disciplines.

Recommendations

The present study was aimed to measure students' cognitive engagement through surface motive, surface strategy, deep motive and deep strategy through online teaching. Since online teaching was relatively a new phenomenon during pandemic so this study provides insights for teaching students online by keeping in mind their learning needs. The result of this study can also be considered to prepare online teaching practices at institutional level to address students' remote learning issues and understanding of the concepts followed by responsive learning approach. This study adds significance to include more concrete and hands on learning approach via remote learning. The results can also overlay the way for additional research in this genre precisely in Pakistan.

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