COVID-19 and its impact on educational environment in India

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Abstract

The impact of COVID-19 has revamped all aspects of human life including education sector, and it has completely changed the educational environment across the globe. Due to the pandemic, the methodical functions of educational institutions have stopped, and new phases have started like online class, online evaluation, and indoor activities. Students are the vital players in education sector, and their opinions play an indispensable role while formulating the policies by the government. In the pandemic, students' perspective on education environment finds new dimension. Therefore, this paper has made an honest attempt to know the coastal Karnataka students' stance on college educational environment. In this study, six major components of education environment are considered, namely (1) online class, (2) teaching and learning, (3) evaluation, (4) college administration, (5) extracurricular activities, and (6) teachers. The study is descriptive in nature, and data was collected from 347 college students of Coastal Karnataka. To support the main objective, a hypothesis has been developed with the help of review of literature and is tested by using ANOVA and independent t-test. The path analysis is used to analyze the casual relationships among components of college educational environment, overall perception, and student performance. The result of the study found that the college students have positive perception towards online class (M=3.14), teaching and learning (M=3.704), evaluation (M=3.38), college and administration (M=3.83), extracurricular activities (M=3.87), and teachers (M=3.63). The result of the hypothesis testing revealed that there is no significant difference in the student perception towards various components of college education system. Path analysis results show that there is relation and effect between components of college education, overall perception, and students' performance. The study concludes that students agree with policies and actions taken by colleges to carry out classes during COVID-19 pandemic irrespective of demographic and educational difference.

Keywords COVID-19 · Students · Post-pandemic · Education · Educational environment

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Introduction

The United Nations Educational, Scientific and Cultural Organization (UNESCO 2015) recent publication reported that "the nationwide closures have impacted over 60% of world's student population (UNESCO 2020). Several other countries have implemented localized closures impacting millions of additional learners" (Charissi et al. 2020). Besides, "social distance" and "online learning" completely changed the perception of students towards educational environment (Arora et al. 2021a; Rakic et al. 2020; Sheen et al. 2020). The educational catastrophe caused by COVID-19 ensued in teachers being compelled to entrust on digital technology as the primary teaching and learning means irrespective of their contemporary technology-related credence and practices (Attard and Holmes 2020). The COVID-19 pandemic has convulsed the lives of students in various paths, depending not only on their level and course of study but also on the specific phase they have reached in their programs. Those concluding one stage of their education and marching towards another, such as those passing from school to tertiary education or from tertiary education to employment, encounter particular challenges (Daniel 2020). Online sessions downed repetitious regime, best employment of time, and effortless approach to study materials (Zhang et al. 2020), and students felt emotional detachment with teachers (Gasser et al. 2018). Students are driven towards self-learning and not to agonize of COVID and sleep peacefully (Khan et al. 2020). However, many studies find psychological problems faced by students during COVID situation (Arora et al. 2021b; Pragholapati 2020; Sheen et al. 2020). Most frequent factors hindering the learning process is the limitation on the number of participants, time limitation of the sessions, and technical faults during the conduct of sessions (Cheng and Lam 2021; Kecojevic et al. 2020). The COVID-19 pandemic taught the entire society on how indispensable is the mother of contrivance, by allowing educational institutions to espouse online learning and interpolate a virtual learning exercise. The pandemic has been navigating the education sector forward with technological revolution and expansion. The pandemic has notably disturbed the higher education sector (Aristovnik et al. 2020). The challenges in learning in post-pandemic period augmented the academic stress among high school level students (Mazumder et al. 2021), and it completely changed students' view on academic life (Crosby et al. 2020; Dewi and Wibowo 2020). Taking into account the looming new normal post-COVID-19 period, an emendation of education within the course of study prospective is crucial. There is an enormous replication archetype of instructional evaluation in online mode of teaching.

Synchronous and asynchronous modes form the basis of online pedagogy (Ho et al. 2020). In the synchronous form, the tutor and the tutee operate jointly at a scheduled time in online mode with the help of Zoom programs (Tan 2021). Learning can also happen with the help of mobile devices like phone in which the instructor gives appraisal to the students concurrently. The asynchronous form does not involve learning between the teacher and the student through online mode (Agarwal et al. 2020). They are put in various places and times to learn various concepts of the subject (Tinsley 2020). Moodle is the instrument used to fulfill this kind of evaluation, wherein the teacher assigns teaching material through posts for the tutees (Ozili 2020). In the early stage of COVID, students find difficult in virtual learning (Gallo et al. 2020; Kumar et al. 2020) but later accustomed online learning (Snipes and Tran 2017). Amidst this pandemic, some universities conducted online exams, but they found significant difference in the academic integrity behavior among students (Welsen et al. 2020). Totally, pandemic changed the mindset of students in post COVID; therefore, with this intention, the study made an earnest attempt to know the perception of the students towards college education after the outbreak of COVID-19 in India. The study analyzes whether the demographical variable and educational profile of students will have difference on perception towards college educational environment.

Literature review

In order to elucidate the research gap and to uphold the objective, the review of literature is conducted. Reviews are collected under two sections; they are (1) Impact of COVID on education and (2) Indian education system. The summary of reviews is discussed below.

Impact of COVID on education

Recognizing the imminent new normal post-COVID-19 phase, an amendment of educational environment within the curriculum studies viewpoint is essential (Khan et al. 2021). There is a huge similarity of instructional evaluation to online. Within the online instructional evaluation, there are synchronous and asynchronous forms (Tinsley 2020). Synchronous and asynchronous modes form the basis of online pedagogy. In the synchronous form, the tutor and the tutee operate jointly at a scheduled time in online mode with the help of Zoom programs (Chaves et al. 2021). Learning can also happen with the help of mobile devices like phone in which the instructor gives appraisal to the students concurrently (BUDI and Anshori 2020). The asynchronous form does not involve learning between the teacher and the student through online mode. They are put in various places and times to learn various concepts of the subject. Moodle is the instrument used to fulfill this kind of evaluation, wherein the teacher assigns teaching material

through posts for the tutees (Joshi et al. 2020). Tutoring and instructing involves various expertise and frames of mind communicated by way of deportment of the instructor and is dominant in molding the behavior of the pupil. The duty, which the society awaits the educator to undertake, is a synthesis of numerous aspects, some integral and divergent (Fatimah et al. 2021). Thus, a sole learner's self-image and esteem emerges out of complete synergy, communication, and cooperation in the learning room, because physical learning halls and labs provide psychological aura, whereby there is deep learning instructiveness between the instructors and learners (Mok et al. 2021). The teacher can then invigorate the knowledge students have of a subject by scrutinizing the conception, then enforcing, and evaluating (Jebaseelan 2016). Finally, integration and progression are the highest tiers of the pyramid; they ascertain if a student truly contemplated the topic being taught. In 2001, however, Bloom's was revised to contain the categories of Remember, Understand, Apply, Analyze, Evaluate, and Create. Bloom's Taxonomy was patterned to allow teachers to have directions of how to teach students (Chandra 2020; Pan 2020; Ratten 2020). While the present circumstance is untypical, which is strenuous to forecast the consequence on the learner's capability and achievement, because of lack of pertinent information, a profound pursuit is to take into account the economics and sociology published works in an attempt to obtain a better beneficial awareness of the consequence of the pandemic and actual ceasing of tangible operation of educational institutions on teaching and schooling (Di Pietro et al. 2020). The study report focuses on a particular learning phase or learners' age class that is college students. But majority of the discussions proposed imply to all learning stages, a few of them are pertinent (or more pertinent) for a specific stage of learners (Revilla-Cuesta et al. 2021). Our discussion may benefit lawmakers in working out mediations and plans to deal with the aftermath of the pandemic disaster, as far as college education in India is concerned, and it may serve as a lifeline concerned stakeholders (Mazumder et al. 2021). Ceasing of tangible working in the educational institutions and the practice of distant learning may have an adverse impact on the learners' learning capacity by way of four means: decrease in time allotted for learning, mental pressure and strain, a transformation in students' learning behavior, and inadequate learning stimulation. The shutting down of buildings of the educational institutions and a transference to a distant learning domain culminate in students engaging short time in learning (Eshet et al. 2021; Soland et al. 2020). Students who are constricted in their houses with their family members due to COVID-19 may feel more pressurized and perturbed (Brouwer et al. 2021). It may change the perception of students on environment of education, and this study analyzes the perception of students in post-pandemic period.

Educational environment in India

Education is the progression of erudition or getting of knowledge, skills, values, and habits of essential needs of life (Bhattacharya 2015). Education normally takes place under the instruction of an educator but not necessarily under one formal system, one can also adopt self-learning(Arora et al. 2021a; Welsen et al. 2020). Thus, education can be formal or informal, but the predominant objective should be developmental effect on the way one thinks and feels, or action is regarded as education (Ali 2020). Education environment is a multi-dimensional domain which includes colleges, students, academic contents, teachers, and extracurricular activities (Lawrence et al. 2021). India is the land of opportunities; many multinational companies want Indian caliber to operate for them not only because Indians are assiduous but have the skill exactitude in them (Tilak 2020). India is the second largest education system in the world, and it has significant history. The Indian educational environment's journey right from Gurukuls to IITs has faced many ebbs and flows. "Right to education Act" has played a predominant role in the educational environment of India, and it has expanded the number of enrollments in higher education in India (Fallatah 2020). The number of universities has also increased in the last 50 years, from 20 universities in 1950 to 875 in 2017. As the number of universities increased and diversified in terms of course offered by colleges, the society is more concerned about the quality of programs, internal rankings, and public evaluations. This process focuses attention towards research-oriented evaluation, but if it fails to measure the quality of educational environment, then it is inevitable because measuring the quality of educational environment is a complex process (Lawrence et al. 2021; Srimathi and Krishanmoorthy 2019). The success of Indian educational environment depends on the contributors of education structure such as administration, students, and teachers. Moreover, the perception of students towards all these aspects is also quintessential (Balhara et al. 2020). Therefore, research is undertaken to analyze the perception of students towards major components of college education environment.

Components of college educational environment

In a broader sense, educational environment includes many components such as government policy, school policy, societal aspects, and curriculum aspects, but when we look at students' perspective, the components of college education environment get reduced to 5 parts. These components are identified as (1) teaching and learning, (2) activities, (3) evaluation, (4) college and administration, and (5) teacher. In addition to these five components, one more component is added as part of education environment due to COVID-19 pandemic (Bryant et al. 2019; Cahapay 2020; Le Quéré et al. 2020),

and this component is identified as "online class." Therefore, for this study, researcher has included this new component for analysis of students' perception towards educational environment, as this study is undertaken post-COVID-19 period. Each component has its own scope and meaning, which is discussed below.

Teaching and learning

Learning is about change; the change achieved by building up another ability, understanding a logical law, changing a mentality, and instructing is a bunch of occasions, outside the students which are intended to help inner cycle of learning (Sawarkar and Sawarkar 2020). Learning is a process of permanent change in thinking, action, and behaviors usually made with an intention. Learning can be formal way or informal way, but intention is to bring intellectual change (Falcone 2020). Learning is an internal factor, but teaching is an outside factor which means learning must come within learners, but teaching comes from outside the learners. Teaching is a complex component of educational environment which will affect what will happen in a classroom through interaction among teaching factors such as teachers, students, local settings, curriculum, and others (Hair 2020). Both teaching and learning are the important components of educational environment, and it has a major influence on the perception of the students.

Extracurricular activities

A variety of activities outside the formal curriculum are referred to as extracurricular activities (Keen and Hall 2009). Extracurricular activities are found at all levels of schools and colleges in different form (Oraif and Elyas 2021). Even though extracurricular activities are not considered for academic performance, it plays an important role in personality development and career advancement. Therefore, it is a part and parcel of educational environment (Samat et al. 2020). For overall development of college educational environment, every college gives equal importance to both curriculum and extracurricular activities.

Evaluation

To measure the performance of students, there should be one quantitative technique, and that quantitative technique is called evaluation or assessment (Dochy et al. 2005; Skarphedinsson 2006). There are two types of evaluation setting, one is "conventional form" and another one is "modern day evaluation." The conventional form of evaluation includes in the form of multiple-choice examination and essay type (Sawarkar and Sawarkar 2020), and modern-day evaluation environment includes portfolios, self and peer assessment, simulations, and other innovative methods. As educator

evaluates the performance of students, it would influence learning interest. Evaluation is logically and empirically one of the defining parameters of students' perceptions to learning (Cano et al. 2020; Coubergs et al. 2017; Han and Ellis 2019).

College and administration

Management or administration and policies taken by administration department have significant impact on the learning interest of the students (Mok et al. 2021). It also pointed that actions taken by college administration will have indirect impact on education environment; if management follows legitimate decisions, it will have positive impact on overall education environment. Therefore, it is important to understand the perception of students towards college and its administration.

Teacher

According to Cambridge Dictionary, "Teacher is a person whose job is to teach in schools or colleges." There are many researchers conducted study on students' perception towards teacher, and study revealed that teachers' behavior will have positive impact on learning (Muthuprasad et al. 2021; Schwab et al. 2018; Stormon et al. 2019), and teachers can inspire or motivate the students for better learning (Joshi et al. 2020; Vega-Hernández et al. 2020). Since teachers have greater role in overall development of student, it is important to analyze the perception of students towards their teachers.

Online class

Online class is a form of class where learner can take course or participate in any education through the Internet rather than attending in person (Bao 2020). COVID-19 pandemic made compulsory to every schools and colleges to take online class, and now it became one of the integral parts of educational environment (Ali 2020; Bestiantono et al. 2020). As it was the only option for conducting class during pandemic, some students opined it as difficult (Kulal and Nayak 2020); therefore, it is important to understand "Is its online class boon or bane." How students perceived online class is important element while analyzing the educational environment.

Research methodology

This study is focused on determining the perception of undergraduate and postgraduate students towards college education environment in coastal Karnataka. Descriptive research design has been followed in this study, and it aims to analyze the respondents' perceptions on various components of college education environment, namely (1) online class, (2) teaching learning, (3) college activity/ECA, (4) evaluation, (5) college

and administration, and (5) the teachers. Each component of the mentioned variable is measured as suggested in the study by Boukhechba and Bouhania 2019; Muthuprasad et al. 2021) and some modifications were made to adjust according to the COVID-19 situation in Indian context. Questionnaire consists of two parts; first part is related to personal profile of the college students, and second part consists of students' perception towards various parameters of college educational environment. Here, "Perception on Online Class (POC)" was measured by eight statements, "Perception on Teaching & Learning (PTL)" was measured by eight statements, "Perception on Activities (PACT)" was measured by four statements, "Perception on Assessment & Evaluation (PAE)" was measured by three statements, "Perception on College & Administration (PCA)" was measured by eight statements, and "Perception towards Teachers (PT)" was measured by four statements. After constructing questionnaire, a pilot study was conducted to know the feasibility and understandability of the questionnaire. In the pilot study, it was found feasible and understandable to the college students. Later, data was collected from 347 undergraduate and postgraduate students, which consists of 217 undergraduate students and 130 graduate students. The study was carried out by taking five universities of Karnataka such as Mangalore University, Srinivas University and Yenepoya University, Bangalore University, VTU Belagavi, Nitte University, and Manipal University which represents south, east, west, and north regions of the states. Questionnaire was distributed using a proportional stratified sampling method. Sampling frame was designed with the help of enrollment details provided by each university's website. Later, based on the number of students from university, sample has been selected using Taro Yamane formula (Tang et al. 2018). Second part of the questionnaire measures students' perception on college educational environment by asking statements in five-point Likert scale, where 1 was strongly disagree (SD), 2 was disagree (D), 3 was neutral (N), 4 was agree (A), and 5 was strongly agree (SA). After collecting the data, the responses were recorded in SPSS, and reliability test was conducted for each components of college educational environment. Table 1

Table 1 Reliability and validity results

Variables	Cronbach's alpha	Number of items	Mean
POC	0.785	8	3.14
PTL	0.721	8	3.70
PACT	0.743	4	3.38
PAE	0.717	3	3.83
PCA	0.863	8	3.87
PT	0.833	4	3.86

Source: Data analysis

exhibits that the Cronbach's value for "Perception on Online Class (POC)" is 0.785, "Perception on Teaching and Learning (PTL)" is 0.721, "Perception on Activities (PACT)" is 0.743, "Perception on Evaluation (PAE)" is 0.717, "Perception on College and Administration (PCA)" is 0.863, and "Perception on Teachers (PT)" is 0.833. According to Chong and Carole (2017) and Hair Jr. et al. (2017), the acceptable value of Cronbach's alpha is 0.7 and above. The Cronbach's alpha of all the six variables was found to be above 0.7, which fulfills the condition.

Validity

Validity testing means testing the instrument whether it has ability to measure what it intends to measure. The two forms of validity testing are (1) content validity and (2) construct validity.

Content validity

A research instrument must consist of a comprehensive list of items and constructs. These can be generated initially from the existing review of literature available. After generating the required variables, the next step was to ensure that the statements included in the research instrument were easily understandable and commands the required content validity. For this, a careful validation process was employed. The instrument was first given to five research scholars, and their remarks about the questionnaire were obtained. Next, 3 professors who were experts in the field of education, psychology, and statistics were requested to examine the instrument, and their suggestions were recorded. Following this, one administrative staff from the university was requested to give his opinion. These suggestions were given due consideration, and the variables included in the questionnaire were added, deleted, and suitably modified. Thus, the questionnaire content validity was confirmed based on the opinions and suggestions of the subject experts, and some changes were made to make the questionnaire clear, more understandable, and purposeful.

Construct validity

The research instrument must consist of a comprehensive list of items and constructs. These items and constructs can be generated initially from the existing review of literature available. Variables used for measuring the components of college educational environment especially on online class, teaching and learning, co-curricular activities, evaluation, college and administration, and perception on teachers of the students of selected university of Karnataka were collected from an extensive review of literature. After generating the required variables, the next step is to ensure that the statements included in the research instrument is easily understandable

and commands the required content validity. For this, a careful validation process was employed.

These suggestions were given due consideration, and the variables included in the questionnaire were added, deleted, and suitably modified. Thus, questionnaire content validity was confirmed based on the option and suggestion of the subject experts.

Testing the assumption of normality

The alternative hypothesis is that there is a significant departure from normality. The present study is based on the skewness, and kurtosis value of normality of the data has been decided. According to Hair (2020) and Cobanoglu et al. (2019), data is normal if skewness is between −2 and +2 and kurtosis is between −7 and +7. Kolmogorov-Smirnov(K-S) test and Shapiro-Wilk test are conducted to fill the assumption of normality. The present data which is measured in metric falls under above category fulfills the normal distribution assumption. A point-biserial correlation method is used to know the relation between demographic and education background variable and components of college education, one sample t-test is used to know whether the mean value of each variable of single components is equally distributed or not, t-test for independent and one-way Anova is used to know the significant difference among the demographical variable and education background variable with respect to components of College education. Path analysis is used to know the effect of components of college education to overall perception and student performance.

Data analysis and interpretation

Data collected was tabulated, and analysis was carried out by using simple percentage analysis, descriptive analysis using mean and standard deviation, and inferential analysis such as t-test and ANOVA. Path analysis is used to know the various effect and relation between variables. Data was analyzed as follows.

Demographical and educational details of the students

Demographic and educational details were collected to know the background of the students such as gender, living location, stream of the study, types of college, and their grade point average. This will help us to understand the diversity of students in research area. The details are given below.

Table 2 explains the demographic and educational details of the respondents which indicate that most of the students (74.1%) are female and only 25.9% are male. It exhibits that 42.9 % of the respondents are living in urban and 40.6% of the

Table 2 Demographic and educational details of the students

Demographical and educational variable	No. of respondents	Percentage
Gender		
Male	90	25.9
Female	257	74.1
Living location		
Urban	149	42.9
Rural	141	40.6
Semi urban	57	16.4
Stream of the study		
Commerce/management	254	73.2
Humanity (arts)	67	19.3
Science	26	7.5
Type of college		
Government college	37	10.7
Private college	168	48.4
Aided college	27	7.8
Autonomous college	115	33.1
Grade point average		
10-8	123	35.4
8-6	176	50.7
6-4	41	11.8
4-0	7	2.0

Source: Primary data

respondents are from rural areas and remaining respondents belong to semi-urban. While considering educational details of students, it showed that most of the students (73.2 %) are from commerce and management stream and remaining are from humanity and science department. The table exhibits that 48.4 % students are pursuing their higher education in private educational institutions and only 10.7% of the college students are from government colleges. It also revealed that majority of the college students (50.7%) belong to the grade point of 8-6 and 35.4% of the college teachers belong to grade point average of 10-8. From the analysis, it can be inferred that there is equal distribution in the frequency of students among demographic and educational variables.

Students' perception on online class in post COVID

The importance of online classes has increased in post-COVID period, and it has become an integral part of the educational environment. To measure the students' perception on online class, descriptive analysis was conducted and to know whether students' have positive perception or negative perception about online class. If mean value is greater than three, then it is considered as positive perception, and if mean value is less than three, then it is considered as negative

Table 3 Descriptive analysis of students' perception on online class

Statement on online class	Mean	SD	t value	P value
The teaching is often stimulating	3.40	.987	7.50	< 0.001**
I find it easy to engage in the lesson	3.01	1.16	.093	>0.05
I feel able to ask the questions I want	3.15	1.17	2.43	< 0.001**
I enjoy online teaching	2.94	1.27	−.85	>0.05
I prefer online teaching to be more interactive and connected	3.43	1.15	7.02	< 0.001**
I feel that online teaching is as effective as in contact teaching	2.67	1.28	−4.75	< 0.001**
I prefer online teaching over contact teaching	3.01	1.31	.082	>0.05
My Internet connection may be problematic	3.49	1.19	7.71	< 0.001**
Overall	3.14	0.75		

Note: ** denotes significance at 1% level

perception, provided that the differences are found to be significant. Table 3 depicts the descriptive analysis and one sample t-test result for perception of students towards online class.

The above table reveals that the students agree that the online teaching is often stimulating (M=3.40), and they opined that online teaching is more interactive (M=3.43). It also revealed that "Internet connection may be problematic" showing the highest mean value 3.49 with S.D. 1.191 and "online teaching is as effective as in contact teaching" with lowest mean value 2.67 and S.D. 1.277. Since p < 0.001, we can conclude that perception of students regarding online class is significantly different than the average perceptions regarding the online class of the students except the statement of "I find it easy to engage in the lesson" and "I enjoy online teaching and I prefer online teaching over contact teaching." The overall mean and standard deviation are 3.14±.75, which indicates that college students have positive perception about online class.

Students' perception towards teaching and learning

The fear of getting COVID-19 and lockdown made students miserable, and it adversely affected the teaching and learning behavior of both tutor and pupil (Ramesh, 2020). It may change the perception of students towards teaching and learning. Table 4 exhibits the descriptive analysis and t-test for perception of students on teaching and learning.

Table 4 indicates that the college students agree that during post COVID-19, the role of the teacher is to facilitate learning rather than teaching syllabus content (M=3.69), and they also agree that during pandemic, learning should be self-motivated rather than external motivation. Students strongly agree that classroom teaching is more effective than online class (M=4.05), and it gives opportunity for better discussion (M=4.24). Since $p < 0.001$, we can conclude that the mean of perceptions of students on teaching and learning is significantly different than the average perceptions of online class of the students. The overall mean and standard deviation is 3.70

±0.58, which indicates that college students have positive perception about teaching and learning. Considering the

Table 4 Descriptive analysis on students' perception towards teaching and learning

Statement on teaching and learning	Mean	SD	t value	P value
Post-COVID, teachers will assume the role of mentors to facilitate learning rather than teaching only the content in the syllabus	3.69	.90	14.08	< 0.001**
Following the pandemic, school attendance will not be made compulsory as students can join the class online	3.80	1.05	14.20	< 0.001**
Following the pandemic, learning should be self-motivated	3.70	1.16	11.25	< 0.001**
E-books and videos will replace the textbooks	3.39	1.22	6.04	< 0.001**
Online classes will continue even after the school reopens	3.28	1.19	4.29	< 0.001**
Self-learning module provides more flexibility for the students to learn at their own pace	3.48	1.09	8.11	< 0.001**
Classroom teaching is more effective than online class	4.05	1.12	17.59	< 0.001**
Classroom teachings gives opportunity for better discussion	4.24	.957	24.11	< 0.001**
Overall	3.704	0.58		

Note: ** denotes significance at 1% level

descriptive results, classroom teaching gives opportunity for better discussion, which shows the highest mean value 4.24 with S.D. 0.96, and online classes will continue even after the school reopens with lowest mean value 3.28 with S.D. 1.19.

Students' perception towards extracurricular activities

In the recent days, colleges are giving equal importance to extracurricular activities and academic activities. Students also understood the importance of extracurricular activities for their personality development and career growth. But in this pandemic period, most of the outdoor activities stopped, and it has adversely affected the behavior of students. Therefore, researcher is interested to know the students' perception on backseat of ECA during the pandemic. Table 5 indicates the descriptive analysis and t-test for perception of students on co-curricular activities.

Table 5 indicates that college students agree that individual games will be preferred over team sports (M=3.45) and activities like debate, discussion, and performances will be shifted completely to online medium (M=3.29). It also revealed that activities like annual functions will take a backseat and shows the highest mean value 3.53 with S.D. 1.20 and virtual tours will replace excursions and school picnics with lowest mean values 3.28 with S.D. 1.27. Since p < 0.001, we can conclude that the mean of perceptions of students on co-curricular activities is significantly different than the average perceptions of co-curricular activities of the students. The overall mean and standard deviation are 3.45±1.25, which indicates that

college students have positive perception towards teaching and learning.

Students' perception towards evaluation

During the pandemic, assessment and evaluation also became online, but the accuracy of evaluation through online is always doubtful. Some students may not be convenient in online evaluation system, but some find it is easy (Ramesh,2020). Therefore, it is important to analyze the perception of students towards evaluation system. Table 6 exhibits the descriptive analysis and t-test for students' perception on evaluation.

Table 6 revealed that the college students agree that online assignments will be preferred because they increase punctuality in schoolwork submission (M=3.95), and they agree that offline exams will be replaced by online tests as they are convenient to attempt (M=3.73). It also revealed that college students agree that open-book tests are an effective way of evaluating the students as there are no issues of cheating (M=3.84). Since $p < 0.001$, we can conclude that the mean of perceptions of students on evaluation is significantly different than the average perceptions of evaluation of the students. The overall mean and standard deviation is 3.83±.81, which indicates that the college students have positive perception towards evaluation system in post-COVID-19 period.

Students' perception towards college and administration

Decisions and policies made by college and administration are crucial for students' learning behavior; therefore, it is important to analyze the students' perception towards college and

Table 5 Descriptive analysis of students' perception on co-curricular activities

Statement on co-curricular activities	Mean	SD	t value	P value
Individual games will be preferred over team sports	3.45	1.03	8.10	< 0.001**
Co-curricular activities such as debating, discussions, performances, and literary competitions will be shifted completely to online medium	3.29	1.16	4.67	< 0.001**
Activities like annual functions will take a backseat	3.53	1.20	8.20	< 0.001**
Virtual tours will replace excursions and school picnics	3.28	1.27	4.05	< 0.001**
Overall	3.38	0.87		

Note: ** denotes significance at 1% level

Table 6 Descriptive analysis of students' perception on evaluation

Statement on evaluation	Mean	SD	t value	P value
Offline exams will be replaced by online tests as these are more convenient to attempt	3.73	1.08	12.41	< 0.001**
Open-book tests are an effective way of evaluating the students as there are no issues of cheating	3.84	1.05	14.76	< 0.001**
Online assignments will be preferred because they increase punctuality in schoolwork submission	3.95	1.01	17.53	< 0.001**
Overall	3.83	0.81		

Note: ** denotes significance at 1% level

Table 7 Descriptive analysis of students' perception on college and administration

Statement on college and administration	Mean	SD	t value	P value
Students and college administration will be more cautious of sanitation	3.91	.95	17.85	< 0.001**
College timings (college hours) will be reduced	3.91	1.04	16.09	< 0.001**
College will include protective gear such as masks and gloves as part of their compulsory uniform	4.07	.92	21.31	< 0.001**
Private transports will be preferred over college transports for the commute	3.84	.96	16.14	< 0.001**
The teacher-student ratio will decrease in classes to uphold social distancing guidelines	3.87	.98	16.34	< 0.001**
I feel comfortable in this college	3.92	1.02	16.72	< 0.001**
Students are accepting of each other in this college	3.87	.96	16.60	< 0.001**
College treats students fairly in post-COVID-19	3.86	1.00	15.76	< 0.001**
Overall	3.87	0.71		

Note: ** denotes significance at 1% level

administration. Table 7 indicates the students' perception towards college and administration.

Table 7 showed that the college students agree that college administration will be more cautious of sanitation (M=3.91) and school timings (M=3.91). It states that the college students strongly agree that college will include protective gear such as masks and gloves as part of their compulsory uniform. College students also agreed that private transport will be preferred over college transport (M=3.84), and they also agreed that the students-teacher ratio will decrease in classroom to uphold social distancing guidelines. Since $p < 0.001$, we can conclude that the mean of perceptions of students on college and administration is significantly different than the average perceptions of online class of the students. The overall mean and standard deviation is 3.87±0.71, which indicates that the college students have positive perception towards college and administration in post-COVID time.

Students' perception towards teachers

Teachers have important role in constructing the behavior of students, and they will be model for the students. Teacher's action and behavior in the class directly impact the level of motivation to learn among college students (van Wyk 2020). Table 8 explains the descriptive analysis and t-test for students' perception towards teachers.

It is revealed from Table 8 that the college students strongly agree that getting assignments from the subject which they study at present from their teachers (M = 4.11) and they also agreed that the teachers help them to implicate, what they learn and how it can be used for learning in new dimensions (M=3.96). Students agreed that teachers use a variety of resources to conduct classroom activities (M=3.59), and teachers encourage the students to visualize the problems positively and find new ways to solve problems (M=3.79). Since $p < 0.001$, we can conclude that the mean of the perceptions of students on co-curricular activities is significantly different

than the average perceptions of co-curricular activities of the students. The overall mean and standard deviation are 3.63 ±0.75, which indicates that college students have positive perception on teachers.

Hypothesis testing

The hypotheses are developed to support the objective of the study. The hypotheses are tested and analyzed as follows:

H_1: There is a significant difference in the students' perception among demographic and education variables.
To test the above hypothesis, sub-hypothesis is developed, they are.
H_1a: There is a significant difference in the perception among male and female.

Table 8 Descriptive analysis of students' perception on teachers

Statement on perception of students on teachers	Mean	SD	t value	P value
We get assignments from the subject which we study at present from our teachers	4.11	.81	25.56	< 0.001**
Our teacher teaches us to learn new things using our already learnt concept	3.96	.86	20.81	< 0.001**
Our teachers use a variety of resources to conduct classroom activities	3.59	1.00	10.95	< 0.001**
Our teachers encourage us to look at the problems from a new perspective and to find the optimal solution	3.79	.99	14.89	< 0.001**
Overall	3.63	0.75		

Note: ** denotes significance at 1% level

Table 9 Test result of significant difference in the perception among gender

Components of college educational environment	Gender				t value	P value
	Male		Female			
	Mean	SD	Mean	SD		
Online class	3.01	.83	3.18	.72	−1.86	.063
Teaching and learning	3.69	.60	3.71	.58	−.26	.794
Co-curricular activities	3.41	.89	3.38	.88	.35	.728
Evaluation	3.89	.90	3.81	.77	.85	.397
College and administration	3.79	.84	3.90	.65	−1.15	0.254
Teachers	3.66	.93	3.93	.66	2.61	<0.001**

**denotes significance at 1% level

H_1b: There is a significant difference in the perception among living location.

H_1c: There is a significant difference in the perception among stream of the study.

H_1d: There is a significant difference in the perception among types of college.

H_1e: There is a significant difference in the perception among grade point.

H_2: There is a positive effect of components of college education to overall perception and student performance. The results of hypothesis testing are discussed below:

H_1a: There is a significant difference in the perception among male and female.

As to know; if there is a significant difference in the students' perception towards components of the college educational environment between male and female counterparts? An independent sample t-test was used and the result is discussed as follows.

Table 9 exhibits the test result for significant difference in the perception among male and female counterparts. It showed that there is no significant difference between male and female with respect to perception on various components of college educational environment. Since p value is greater than 0.05, the hypothesis is rejected. Therefore, we can

conclude that both male and female students have positive perception towards college educational environment.

H_1b: There is a significant difference in the perception among living location.

To facilitate whether there is a significant difference in the students' perception towards components of college educational environment among different living location of the students, one-way ANOVA test was used, and result is discussed as follows.

Table 10 indicates the ANOVA result for significant difference among living location with respect to perception on various components of college education environment. It revealed that there is no significant difference in the perception of students on education among living location. Since p-value is greater than 0.05, the hypothesis is rejected. Therefore, we can conclude that students from urban areas, semi-urban areas, and rural areas have same positive perception towards college education environment.

H_1c: There is a significant difference in the perception among stream of the study.

To know whether there is significant difference in the students' perception towards components of college education environment among the stream of study, one-way ANOVA test was used, and result is discussed as follows.

Table 10 Test result on significant difference in the perception among living location

Components of college educational environment	Mean and SD			F value	P value
	Urban	Rural	Semi-urban		
Online class	3.07 (.74)	3.18 (.71)	3.21 (.89)	1.03	.359
Teaching and learning	3.71 (.49)	3.66 (.63)	3.81 (.70)	1.36	.259
Co-curricular activities	3.40 (.90)	3.36 (.85)	3.40 (.92)	.092	.912
Evaluation	3.90 (.77)	3.74 (.82)	3.89 (.87)	1.63	.199
College and administration	3.91 (.68)	3.86 (.64)	3.80 (.90)	.49	.612
Teachers	3.85 (.72)	3.93 (.64)	3.70 (.99)	2.06	.129

Note: The value within parenthesis refers to SD

Table 11 Test result on significant difference in the perception among stream of the study

Components of college education environment	Mean and SD			F value	P value
	Commerce/management	Humanity (arts)	Science		
Online class	3.13 (.76)	3.19 (.73)	3.06 (.76)	.26	.772
Teaching and learning	3.70 (.57)	3.68 (.60)	3.80 (.68)	.37	.688
Co-curricular activities	3.39 (.92)	3.37 (.72)	3.38 (.88)	.009	.991
Evaluation	3.87 (.79)	3.77 (.80)	3.59 (.98)	1.66	.192
College and administration	3.87 (.68)	3.99 (.65)	3.58 (.98)	3.21	**.042***
Teachers	3.88 (.72)	3.91 (.77)	3.5 (.91)	3.33	**.037***

Note: The value within parenthesis refers to SD

Table 11 explains the ANOVA test result for significant difference among stream of the study with respect to perception on various components of college educational environment. It exhibits that there is no significant difference among stream of the study with respect to perception on online class, teaching and learning, co-curricular activities, and evaluation. But it showed significant difference among stream of the study with respect to perception on college and administration and teachers. While observing mean and standard deviation, we can conclude that the students from arts (M=3.99) have higher positive perception on college and administration than students from commerce (M=3.87) and science (M=3.58). It also reveals that the students from arts (M=3.9067) have higher positive perception on teachers than students from commerce (M=3.88) and science (M=3.331).

H₁d: There is a significant difference in the perception among types of college.

To facilitate, is there a significant difference in the Students' perception towards components of college education environment among types of college, One- Way ANOVA test was used, and result is discussed as follows,

Table 12 exhibits that there is a significant difference among type of college with respect to perception on various components of college education environment. It reveals that there is a significant difference among types of college with respect to perception on online class (0.014), co-curricular activities (.000), evaluation (.002), and teachers (0.049). It explains that students studying in autonomous college have negative perception about online class (M=2.98). Students studying in government colleges (M=3.61) have high positive perception towards co-curricular activities than students from other types of colleges. Students from autonomous colleges (M=4.03) have very high positive perception towards evaluation system. It also reveals that students from private colleges (M=3.95) have high positive perception towards teachers than other types of colleges.

H₁e: There is a significant difference in the perception among grade point.

In an attempt to know whether there is significant difference in the students' perception towards components of college educational environment among grade point average, one-way ANOVA test was used, and result is discussed as follows.

Table 13 explains ANOVA result for significant difference among grade average point with respect to perception on various components of college educational environment. It reveals that there is no significant difference among students'

Table 12 Test result on significant difference in the perception among types of college

Components of college educational environment	Mean and SD				F value	P value
	Government college	Private college	Aided college	Autonomous college		
Online class	3.13 (.66)	3.19 (.78)	3.46 (.68)	2.99 (.74)	**3.57**	**.014**
Teaching and learning	3.7162 (.61)	3.75 (.64)	3.64 (.51)	3.65 (.52)	.72	.541
Co-curricular activities	3.61 (.81)	3.54 (.80)	3.25 (.88)	3.12 (.94)	**6.41**	**.000**
Evaluation	3.79 (.64)	3.68 (.85)	3.95 (.78)	4.04 (.76)	**4.93**	**.002**
College and administration	3.66 (.77)	3.86 (.72)	3.77 (.76)	3.99 (.64)	2.39	.069
Teachers	3.72 (.78)	3.95 (.72)	3.57 (.82)	3.84 (.75)	**2.65**	**.049**

Note: The value within parenthesis refers to SD

Table 13 Test result of significant difference in the perception among grade point

Components of college educational environment	Mean and SD				F value	P value
	10-8	8-6	6-4	4-0		
Online class	3.18 (.72)	3.13 (.76)	3.00 (.80)	3.25 (.92)	.60	.616
Teaching and learning	3.75 (.56176)	3.67 (.57)	3.78 (.69)	3.43 (.79)	1.24	.296
Co-curricular activities	3.49 (.84)	3.35 (.87)	3.27 (1.00)	3.18 (.84)	1.02	.384
Evaluation	3.78 (.78)	3.82 (.83)	3.94 (.82)	4.43 (.63)	1.70	.166
College and administration	4.00 (.67)	3.87 (.71)	3.64 (.66)	3.25 (.86)	**4.80**	**.003**
Teachers	4.01 (.69)	3.80 (.76)	3.77 (.72)	3.32 (1.18)	**3.65**	**.013**

Note: The value within parenthesis refers to SD

grade average point with respect to perception on online class, teaching and learning, co-curricular activities, and evaluation. But it shows that there is a significant difference among students' grade average point with respect to perception on college administration (p=.003) and teachers (p=0.013). Since overall p value is less than 0.05, the hypothesis is rejected. Therefore, we can conclude that students' grade average point does not affect their perception on educational environment except perception on college administration and teachers.

Since all sub-hypotheses are rejected at 1% significance level, we can reject main hypothesis, and we can conclude that there is no significant difference in the perception of students towards educational environment during post COVID-19 among their demographic and educational variables (Table 14). Correlation between Components of College education, overall perception, and student performance

Based on the correlation result in the above table, online had a strong relationship with evaluation, perception towards teacher, and overall perception with the value of 0.541, 0.188, and 0.220. Teaching and learning had a strong correlation with ECA, evaluation, college and administration, overall perception, and performance with the value of 0.311, 0.377, 0.225, 0.345, and 582. ECA had a strong relationship with

evaluation, college and administration, teacher, overall perception, and performance with values of 0.351, 0.402, 0.383, 0.145, and 0.662. Evaluation had a strong relationship with college and administration and performance with the values of 0.233 and 0.620. College and administration had a strong relationship with teacher, overall perception and performance with values of 244, 0.144, and 0.597. Teacher had a strong relationship with overall perception and performance with value of 0.162 and 0.634. Overall perception had a strong relationship with performance with value of 0.283.
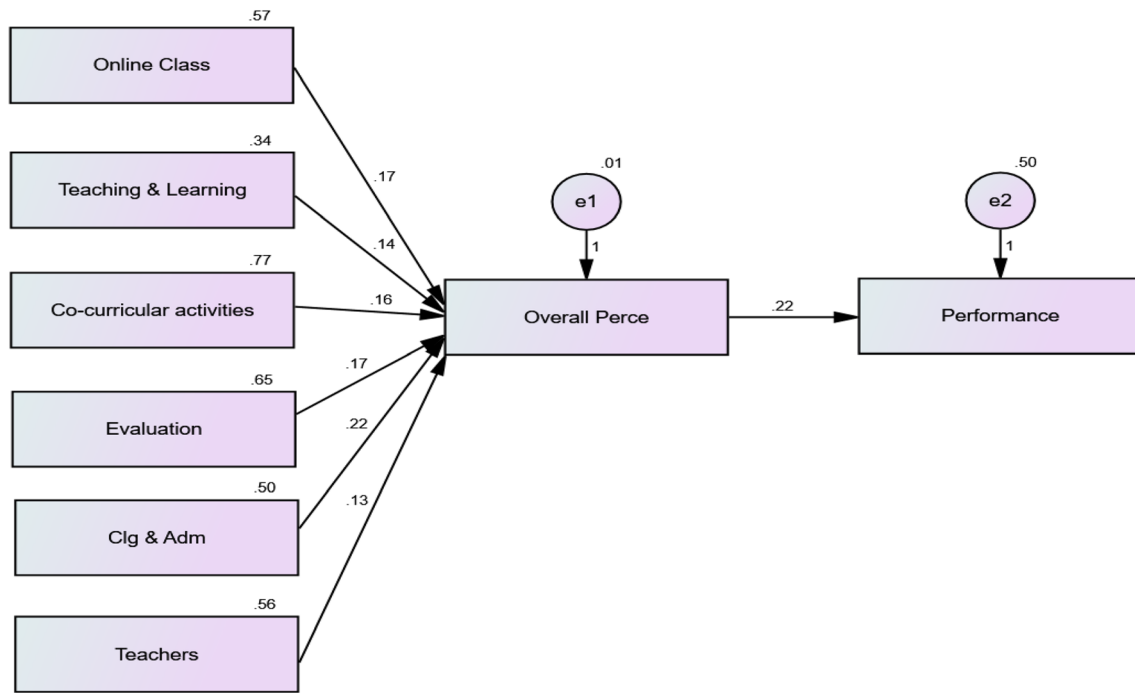
Path analysis

Structural equation modeling (SEM) is used to test the first hypnotized model and estimate the relationship between the various constructs of the model. SEM framework is used to test the proposed conceptual model in the study. Since the validity and reliability results of the data are already verified. The Chi-square goodness of fit results may be used to test whether the data available fits into the proposed conceptual model with the estimated model. The value of this normed Chi-square should not exceed 3 (Hair el el., 2010). The values of GFI, AGFI, NFI,

Table 14 Correlation matrix

Components of college education	Online	Teaching and learning	ECA	Evaluation	College and administration	Teacher	Overall perception	Performance
Online	1	.049	.412*	.541**	−.094	.188**	.220**	.134*
Teaching and learning	-	1	.311**	.377**	.225**	.090	.345**	.582**
ECA	-	-	1	.351**	.402**	.383**	.145**	.662**
Evaluation	-	-	-	1	.233**	.135*	.077	.620**
College and administration	-	-	-	-	1	.244**	.144**	.597**
Teacher	-	-	-	-	-	1	.162**	.634**
Overall perception	-	-	-	-	-	-	1	.283**
Performance	-	-	-	-	-	-	-	1

Note: ** denotes significance at 1% level; * denotes significance at 5% level

Figure 1 Path analysis

and CFI should be in the range of 0.80 to 0.89 to render the model as acceptable, and if the value is above 0.90, the model shall be considered as very good fit model (Hair et al., 2010). By looking at the results of estimation and modification index, some modification and changes are done. Thus, researcher considered on 6 variables to measure components of college educational environment and to see the effect on another dependent variable.

Path model

The path model (Figure 1) is developed by taking the perception of the students on various components of college educational environment and overall perception as moderating factors and performance of the students as outcome variable.

H_2: There is a positive effect of components of college education to overall perception and student performance.

Table 15 displays the values of different goodness of fit indices. The values in respect of the normed Chi-square are 22.436, RMESA is 0.035, GFI is 0.988, AGFI is 0.963, and NFI is 0.953. These values reveal that the results in respect of the validity of the proposed model fall well within the generally accepted limits. This confirms that the available data set appropriately fits into the proposed overall structural model. The path coefficients show the direct effect between variable in the study by considering standardized regression weight. Consider the effect of perception on various components of college educational environment on student grade. The direct effect is .134 (the path coefficient from overall perception to grade). In case

of online class on overall perception, the direct effect is 0.297 (the path coefficient from online class to overall perception). In case of teachers on overall perception, the direct effect is 0.022 (the path coefficient from teacher to overall perception). In case of teaching and learning on overall perception, the direct effect is 0.181 (the path coefficient from teaching and learning to overall perception). In case of college and administration on overall perception, the direct effect is 0.424 (the path coefficient from college and administration to overall perception).

Discussion

The COVID-19 pandemic affected the education sector all over the world, near to temporarily shut down of all activities.

Table 15 Results of goodness of fit test

Fit statistic	Recommended	Obtained
x^2	-	22.436
df	-	15
x^2 significant	$p \geq 0.05$	.097
x^2 /df	≤ 2–5.0	1.496
GFI	≥ 0.90	0.984
AGFI	>0.80	0.903
NFI	≥ 0.90	0.981
RMSEA	≤ 0.05	0.042

Source: Hair et al. (1998, 2010), Hu and Bentler (1999), Byrne (2001, 2010), and Ernest et al. (2008) (Computed primary data)

Due to this sudden action, the players of education sectors such as students, teachers, and college administrator faced difficulties (UNESCO 2020). This study focuses on students' view on college education environment especially in post COVID (March 2020 to January 2021). We found that the students are having positive perception about online class, which is against the findings of Kulal and Nayak (2020). The study of Kamarianos et al. (2020) also confirmed that online class helped these generations than previous generation, and the study found that students believed that online classes stimulate learning behavior of the students. Our study further demonstrates that online classes are not as effective as face-face teaching, which is also proved in the study of Lei et al. (2020). Even though online classes have a positive impact on students learning (Aristovnik et al. 2020), some students face difficulties due to poor Internet connections.

Teaching and learning through online made students undergo new phase of learning, first thing is understanding the technicalities of software and second is understanding the concept of teaching (Bull et al. 2020), but students of Coastal Karnataka felt it as convenient mode for teaching and learning. Students opined that due to COVID-19 pandemic, the role of teachers changed from teaching to facilitator to learning, and they also believed that learning became self-centered. As study of Liberman et al. mentioned classroom teaching is better than online class teaching as it provides more opportunity to interaction. The t-test result found that the opinion of students above the average level is significant that means students are having positive perception about teaching and learning techniques following post-COVID period. Descriptive analysis of students' perception towards co-curricular activities reveals that students are not happy about giving less importance on co-curricular activities, but overall mean and standard deviation (3.38±0.87) indicates college students have positive perception on ECA despite having no outdoor activities.

Yu et al. (2020) confirmed that evaluation and assessment is important to check academic growth, and it also influence students' motivation factor. Due to the pandemic, almost all colleges followed online evaluation environment and assessment. The students of Karnataka opined that online evaluation system is more convenient and online assignment will be preferred because it increases the punctuality among students. The overall mean and standard deviation of PEA explains that college students have positive perception towards online evaluation and assessment system. Decisions and actions of college administration influence learning behavior of students (Teräs et al. 2020). The study reveals that colleges in Karnataka took proper measures for COVID, and it followed guidelines of SOP; this made students comfortable to attend offline classes in first unlock.

Due to the pandemic, the responsibility of teachers increased from teaching to retention of students for online class (Burgess et al. 2021). Due to this, students also increased their expectation from teachers, especially in this crisis. The study found that the students agreed that teachers are helpful in their assignment work, learning concepts, conducting classroom activities, and enhancement of knowledge. According to Daniel (2020), the students' satisfaction and perception towards college education environment is significantly different in demographic factors and educational factors. To test these findings, we developed hypothesis and tested by using independent t-test and ANOVA. The result of our study is contradictory to the result of Sir John Daniel, and this result difference may be due to difference in cultural, nationality, and economic situation of the country. Therefore, we rejected our hypothesis and concluded that there is no significant difference in the perception towards college educational environment among demographic and educational factors of students. Finally, considering the path analysis, there is direct effect of components of college education to overall perception and student's performance.

Conclusion and practical implication

It has been concluded from the study that students have positive perception about college educational environment irrespective of their demographic and educational differences. Online class and online evaluation are the proper measure during pandemic. Post-COVID colleges are giving equal importance to online class and offline class; in addition to this, it also gives equal importance to academic and extracurricular activities. From the literature study and findings of our study, we can conclude that COVID-19 pandemic has changed the perception of students towards educational environment, and it has made students think about education in new dimension.

From the above discussions, we can recommend to college administration to take teaching of at least one subject in online mode because students are adjusted to online class, and this also helps them to prepare for future pandemic. Therefore, we suggest colleges and administration not to eliminate online classes once lockdown is uplifted. We also recommend the government of Karnataka to provide basic infrastructure facilities such as laptops and Internet connections to colleges, so that they can take classes systematically. While considering student's feedback in open ended questions in the questionnaire, we recommend the colleges to continue online class for next 3 months, evaluation should be liberal, and attendance should be liberal. Finally, and most importantly, government must take proper initiatives in providing jobs to the students who have completed their courses during the pandemic period. Therefore, government must take initiative to protect the interest of students; thereby, they can protect the hopes of students on educational environment. In addition to this, government and educational institutions must take utter care to

uplift the positive perception of students towards teaching and learning behavior and to create new ray of hopes on evaluation and assessment in this pandemic situation.

Declarations

Ethics approval and consent to participate Considered.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

References

Agarwal J, Maheshwari S, Agrawal A, Pant M, Chaudhary Y, Naithani M (2020) Impact of COVID 19 lockdown on the study of medical students: a cross sectional survey. *Acta Medica Int* 7(2):86. https://doi.org/10.4103/ami.ami_148_20

Ali W (2020) Online and remote learning in higher education institutes: a necessity in light of COVID-19 pandemic. *High Educ Stud* 10(3):16. https://doi.org/10.5539/hes.v10n3p16

Aristovnik A, Keržič D, Ravšelj D, Tomaževič N, Umek L (2020) Impacts of the COVID-19 pandemic on life of higher education students: a global perspective. *Sustainability (Switzerland)* 12(20):1–34. https://doi.org/10.3390/su12208438

Arora S, Chaudhary P, Singh RK (2021a) Impact of coronavirus and online exam anxiety on self-efficacy: the moderating role of coping strategy. *Interact Technol Smart Educ* ahead-of-print. https://doi.org/10.1108/ITSE-08-2020-0158

Arora S, Chaudhary P, Singh RK (2021b) Impact of coronavirus and online exam anxiety on self-efficacy: the moderating role of coping strategy. *Interact Technol Smart Educ* ahead-of-print. https://doi.org/10.1108/ITSE-08-2020-0158

Attard C, Holmes K (2020) "It gives you that sense of hope": an exploration of technology use to mediate student engagement with mathematics. *Heliyon* 6(1):e02945. https://doi.org/10.1016/j.heliyon.2019.e02945

Balhara YPS, Kattula D, Singh S, Chukkali S, Bhargava R (2020) Impact of lockdown following COVID-19 on the gaming behavior of college students. *Indian J Public Health* 64:172. https://doi.org/10.4103/ijph.IJPH_465_20

Bao W (2020)COVID-19 and online teaching in higher education: a case study of Peking University. *Human Behav Emerg Technol* 2(2):113–115. https://doi.org/10.1002/hbe2.191

Bestiantono DS, Agustina PZR, Cheng T-H(2020) How students' perspectives about online learning amid the COVID-19 pandemic?

Studies Learn Teach 1(3):133–139. https://doi.org/10.46627/silet.v1i3.46

Bhattacharya S (2015) A study on the higher education system in India and factors affecting the choice of teaching career in IT education. *Mediterr J Soc Sci* 6(4S1):62–70. https://doi.org/10.5901/mjss.2015.v6n4s1p62

Boukhechba H, Bouhania B (2019) Adaptation of instructional design to promote learning in traditional EFL classrooms: adobe captivate for E-learning content. *Int J Educ Dev Using Inf Commun Technol* 15(4):151

Brouwer KR, Walmsley LA, Parrish EM, McCubbin AK, Braido CEC, Okoli CTC (2021) Examining the associations between self-care practices and psychological distress among nursing students during the COVID-19 pandemic. *Nurse Education Today*, *100*. 100:104864. https://doi.org/10.1016/j.nedt.2021.104864

Bryant RA, Felmingham KL, Malhi G, Andrew E, Korgaonkar MS (2019) The distinctive neural circuitry of complex posttraumatic stress disorder during threat processing. *Psychol Med* 51:1121–1128. https://doi.org/10.1017/S0033291719003921

BUDI S, Anshori I (2020) Analisis Efektifitas Pembelajaran Online pada Masa Pandemi Covid-19. *FIKROTUNA* 11(01)

Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, Carty C, Chaput JP, Chastin S, Chou R, Dempsey PC, Dipietro L, Ekelund U, Firth J, Friedenreich CM, Garcia L, Gichu M, Jago R, Katzmarzyk PT et al (2020) World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 54(24):1451–1462. https://doi.org/10.1136/bjsports-2020-102955

Burgess, S., Henrik, H., April, S., Burgess, S., & Sievertsen, H. H. (2021). Schools, skills, and learning: the impact of COVID-19 on education. *Voxeu.Org*, *March*, 8–11.

Cahapay MB (2020) How Filipino parents home educate their children with autism during COVID-19 period. *Int J Develop Disabil*:1–4. https://doi.org/10.1080/20473869.2020.1780554

Cano F, Pichardo MC, Berbén ABG, Fernández-Cabezas M (2020) An integrated test of multidimensionality, convergent, discriminant and criterion validity of the course experience questionnaire: an exploratory structural equation modelling. *Assess Eval High Educ* 46:1–13. https://doi.org/10.1080/02602938.2020.1771278

Chandra Y (2020) Online education during COVID-19: perception of academic stress and emotional intelligence coping strategies among college students. *Asian Educ Dev Stud* 10:229–238. https://doi.org/10.1108/AEDS-05-2020-0097

Charissi A, Tympa E, Karavida V (2020) Impact of the COVID-19 disruption on university students' perceptions and behavior. *Eur J Educ Stud* 7(11). https://doi.org/10.46827/ejes.v7i11.3348

Chaves PR, Assumpção RM, Ferreira LC, Cardieri P, Branquinho OC, Fruett F (2021) A remote emulation environment for the teaching of low-power wireless communications. *Comput Appl Eng Educ*. https://doi.org/10.1002/cae.22397

Cheng L, Lam CY (2021) The worst is yet to come: the psychological impact of COVID-19 on Hong Kong music teachers. *Music Educ Res* 23:211–224. https://doi.org/10.1080/14613808.2021.1906215

Chong JH, Carole LHABRA (2017) Industrial management & data systems. *Industrial Manag Data Syst Business Process Manag J Iss Manag Decis* 110(5):111–133

Cobanoglu R, Capa-Aydin Y, Yildirim A (2019) Sources of teacher beliefs about developmentally appropriate practice: a structural equation model of the role of teacher efficacy beliefs. *Eur Early Child Educ Res J* 27(2):195–207. https://doi.org/10.1080/1350293X.2019.1579547

Coubergs C, Struyven K, Vanthournout G, Engels N (2017) Measuring teachers' perceptions about differentiated instruction: the DI-Quest instrument and model. *Stud Educ Eval* 53:41–54. https://doi.org/10.1016/j.stueduc.2017.02.004

Crosby S, Howell P, Thomas S (2020) Teaching through collective trauma in the era of COVID-19: trauma-informed practices for middle level learners. *Middle Grades Rev 6*(2)

Daniel SJ (2020) Education and the COVID-19 pandemic. *Prospects 49*(1–2):91–96. https://doi.org/10.1007/s11125-020-09464-3

Dewi NN, Wibowo R (2020) Factors affecting the learning spirit of students. *Russian J Agric Socio-Econ Sci 3*(99):12–28. https://doi.org/10.18551/rjoas.2020-03.03

Di Pietro, G., Biagi, F., Costa, P., Karpiński, Z., & Mazza, J. (2020). The likely impact of COVID-19 on education: reflections based on the existing literature and recent international datasets. In *Publications Office of the European Union, Luxembourg: Vol. EUR 30275* (Issue JRC121071). https://doi.org/10.2760/126686

Dochy F, Segers M, Van Den Bossche P, Struyven K (2005) Students' perceptions of a problem-based learning environment. *Learn Environ Res 8*(1):41–66. https://doi.org/10.1007/s10984-005-7948-x

Eshet Y, Steinberger P, Grinautsky K (2021) Relationship between statistics anxiety and academic dishonesty: a comparison between learning environments in social sciences. *Sustainability (Switzerland) 13*(3). https://doi.org/10.3390/su13031564

Falcone T (2020) 2.4 Telemedicine as a tool for suicide assessment in the time of COVID-19. *J Am Acad Child Adolesc Psychiatry 59*(10): S125. https://doi.org/10.1016/j.jaac.2020.07.486

Fallatah SA (2020) Senior interior design students' perceptions about distance learning in the shadow of COVID-19. *J Public Health Res 9*(S1). https://doi.org/10.4081/jphr.2020.1914

Fatimah F, Rajiani SI, Abbas EW (2021) Cultural and individual characteristics in adopting computer-supported collaborative learning during covid-19 outbreak: willingness or obligatory to accept technology? *Manag Sci Lett*:373–378. https://doi.org/10.5267/j.msl.2020.9.032

Gallo LA, Gallo TF, Young SL, Moritz KM, Akison LK (2020) The impact of isolation measures due to COVID-19 on energy intake and physical activity levels in Australian university students. In medRxiv. https://doi.org/10.1101/2020.05.10.20076414

Gasser L, Grütter J, Buholzer A, Wettstein A (2018) Emotionally supportive classroom interactions and students' perceptions of their teachers as caring and just. *Learn Instr 54*:82–92. https://doi.org/10.1016/j.learninstruc.2017.08.003

Hair JF (2020)Next-generation prediction metrics for composite-based PLS-SEM. *Ind Manag Data Syst 121*(1):5–11. https://doi.org/10.1108/IMDS-08-2020-0505

Hair JF Jr, Matthews LM, Matthews RL, Sarstedt M (2017)PLS-SEM or CB-SEM: updated guidelines on which method to use. *Int J Multivariate Data Anal 1*(2):107. https://doi.org/10.1504/ijmda.2017.10008574

Han F, Ellis RA (2019) Using phenomenography to tackle key challenges in science education. *Front Psychol 10*(JUN):1–10. https://doi.org/10.3389/fpsyg.2019.01414

Ho, N. T. T., Sivapalan, S., Pham, H. H., Nguyen, L. T. M., Pham, A. T. Van, & Dinh, H. V. (2020). Students' adoption of e-learning in emergency situation: the case of a Vietnamese university during COVID-19. *Interactive Technology and Smart Education*, 2020–2021. https://doi.org/10.1108/ITSE-08-2020-0164, ahead-of-print

Jebaseelan, A. U. S. (2016). *Student learning behavior and academic achievement - unraveling its relationship student learning behavior and academic achievement: unraveling its relationship. September*, 58. https://www.researchgate.net/publication/307964442_Student_Learning_Behavior_and_Academic_Achievement_-_Unraveling_its_relationship

Joshi A, Vinay M, Bhaskar P (2020) Impact of coronavirus pandemic on the Indian education sector: perspectives of teachers on online teaching and assessments. *Interact Technol Smart Educ* ahead-of-print. https://doi.org/10.1108/ITSE-06-2020-0087

Kamarianos I, Adamopoulou A, Lambropoulos H, Stamelos G (2020) Towards an understanding of university students' response in times of pandemic crisis (Covid-19). *Eur J Educ Stud 7*(7):20–40. https://doi.org/10.46827/ejes.v7i7.3149

Kecojevic A, Basch CH, Sullivan M, Davi NK (2020) The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PLoS ONE 15*(9 September): e0239696. https://doi.org/10.1371/journal.pone.0239696

Keen C, Hall K (2009) Engaging with difference matters: longitudinal student outcomes of co-curricular service-learning programs. *J High Educ 80*(1):59–79. https://doi.org/10.1353/jhe.0.0037

Khan, S., Al-Dmour, A., Bali, V., Rabbani, M. R., & Thirunavukkarasu, K. (2021). Cloud computing based futuristic e4ducational model for virtual learning. *Journal of Statistics and Management Systems*, 1–29.

Khan, S., Rabbani, R. M., Thalassinos, I. E., & Atif, M. (2020). Corona virus pandemic paving ways to next generation of learning and teaching: futuristic cloud based educational model. *Available at SSRN 3669832*.

Kulal A, Nayak A (2020) A study on perception of teachers and students toward online classes in Dakshina Kannada and Udupi District. *Asian Assoc Open Univ J 15*(3):285–296. https://doi.org/10.1108/aaouj-07-2020-0047

Kumar A, Nayar KR, Bhat LD (2020) Debate: COVID-19 and children in India. *Child Adolesc Mental Health 25*(3):165–166. https://doi.org/10.1111/camh.12398

Lawrence SA, Garcia J, Stewart C, Rodriguez C (2021) The mental and behavioral health impact of COVID-19 stay at home orders on social work students. *Soc Work Educ*:1–15. https://doi.org/10.1080/02615479.2021.1883582

Le Quéré C, Jackson RB, Jones MW, Smith AJP, Abernethy S, Andrew RM, De-Gol AJ, Willis DR, Shan Y, Canadell JG, Friedlingstein P, Creutzig F, Peters GP (2020) Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. *Nat Clim Chang 10*(7):647–653. https://doi.org/10.1038/s41558-020-0797-x

Lei L, Huang X, Zhang S, Yang J, Yang L, Xu M (2020) Comparison of prevalence and associated factors of anxiety and depression among people affected by versus people unaffected by quarantine during the COVID-19 epidemic in Southwestern China. *Med Sci Monit 26*: 1–12. https://doi.org/10.12659/MSM.924609

Mazumder A, Bandhu Kalanidhi K, Sarkar S, Ranjan P, Sahu A, Kaur T, Kaur D, Bhattacharya A, Priyadarshini Suna S, Prakash B, Deb KS, Wig N (2021)Psycho-social and behavioural impact of COVID 19 on young adults: qualitative research comprising focused group discussion and in-depth interviews. *Diabetes Metab Syndr Clin Res Rev 15*(1):309–312. https://doi.org/10.1016/j.dsx.2020.12.039

Mok KH, Xiong W, Ke G, Cheung JOW (2021) Impact of COVID-19 pandemic on international higher education and student mobility: student perspectives from mainland China and Hong Kong. *Int J Educ Res 105*(54):101718. https://doi.org/10.1016/j.ijer.2020.101718

Muthuprasad T, Aiswarya S, Aditya KS, Jha GK (2021) Students' perception and preference for online education in India during COVID -19 pandemic. *Soc Sci Human Open 3*(1):100101. https://doi.org/10.1016/j.ssaho.2020.100101

Oraif I, Elyas T (2021) The impact of COVID-19 on learning: investigating EFL learners' engagement in online courses in Saudi Arabia. *Educ Sci 11*(3). https://doi.org/10.3390/educsci11030099

Ozili P (2020)COVID-19 in Africa: socio-economic impact, policy response and opportunities. *Int J Sociol Soc Policy 99617*. https://doi.org/10.1108/IJSSP-05-2020-0171 ahead-of-print

Pan S (2020)COVID-19 and the neo-liberal paradigm in higher education: changing landscape. *Asian Educ Dev Stud 10*:322–335. https://doi.org/10.1108/AEDS-06-2020-0129

Pragholapati, A. (2020). *Covid-19 impact on students*. 1–6. https://doi.org/10.35542/osf.io/895ed

Rakic, S., Lolie, T., Lalic, B., Stefanovic, D., & Marjanovic, U. (2020). The acceptance of electronic learning in transition economies: evidence from the Republic of Serbia. *ICETA 2020 - 18th IEEE International Conference on Emerging ELearning Technologies and Applications, Proceedings*. https://doi.org/10.1109/ICETA51985.2020.9379173

Ratten V (2020) Coronavirus (Covid-19) and the entrepreneurship education community. *J Enterprising Commun* 14(5):753–764. https://doi.org/10.1108/JEC-06-2020-0121

Revilla-Cuesta V, Skaf M, Varona JM, Ortega-López V (2021) The outbreak of the covid-19 pandemic and its social impact on education: were engineering teachers ready to teach online? *Int J Environ Res Public Health* 18(4). https://doi.org/10.3390/ijerph18042127

Samat MF, Awang NA, Hussin SNA, Nawi FAM (2020) Online distance learning amidst Covid-19 pandemic among university students: a practicality of partial least squares structural equation modelling approach. *Asian J Univ Educ* 16(3). https://doi.org/10.24191/ajue.v16i3.9787

Sawarkar G, Sawarkar P (2020) Critical appraisal of e-learning through mobile devices in medical education. *Indian J Forensic Med Toxicol* 14(4):6733–6736. https://doi.org/10.37506/ijfmt.v14i4.12675

Schwab S, Sharma U, Loreman T (2018) Are we included? Secondary students' perception of inclusion climate in their schools. *Teach Teach Educ* 75:31–39. https://doi.org/10.1016/j.tate.2018.05.016

Sheen A, Ro G, Holani K, Pinheiro Dos Santos ACZ, Kagadkar F, Zeshan M (2020) 51.7 Impact of Covid-19–related school closures on children and adolescents worldwide: a literature review. *J Am Acad Child Adolesc Psychiatry* 59(10):S253. https://doi.org/10.1016/j.jaac.2020.08.417

Skarphedinsson S (2006) Diagnostik af Borrelia infektion. *Mikro* 30(9):331–347. https://doi.org/10.1080/0260293042000318091

Snipes, J., & Tran, L. (2017). Growth mindset, performance avoidance, and academic behaviors in Clark County School District. *Regional Educational Laboratory West*, April, 1–34. http://ezphost.dur.ac.uk/login?url=https://search.proquest.com/docview/1913348385?accountid=14533%0Ahttp://openurl.ac.uk/ukfed:dur.ac.uk?genre=report&issn=&title=Growth+Mindset%2C+Performance+Avoidance%2C+and+Academic+Behaviors+in+Clark+County+School+Dist

Soland, J., Kuhfeld, M., Tarasawa, B., Johnson, A., Ruzek, E., & Wednesday, J. L. (2020). The impact of COVID-19 on student achievement and what it may mean for educators. *Brookings Institution*, 1–7. https://www.brookings.edu/blog/brown-center-chalkboard/2020/05/27/the-impact-of-covid-19-on-student-achievement-and-what-it-may-mean-for-educators/

Srimathi H, Krishanmoorthy A (2019) The complex structure of higher education system in India. *Int J Innov Technol Explor Eng* 8(9):103–107. https://doi.org/10.35940/ijitee.i7528.078919

Stormon N, Ford PJ, Eley DS (2019)DREEM-ing of dentistry: students' perception of the academic learning environment in Australia. *Eur J Dent Educ* 23(1):35–41. https://doi.org/10.1111/eje.12384

Tan C (2021) The impact of COVID-19 pandemic on student learning performance from the perspectives of community of inquiry. *Corporate Govern (Bingley)* ahead-of-print:2020–2022. https://doi.org/10.1108/CG-09-2020-0419

Tang H, Hashigata K, Chang TFM, Chen CY, Nagoshi T, Yamane D, Konishi T, Machida K, Masu K, Sone M (2018) Sample size effect on micro-mechanical properties of gold electroplated with dense carbon dioxide. *Surf Coat Technol* 350:1065–1070. https://doi.org/10.1016/j.surfcoat.2018.02.041

Teräs M, Suoranta J, Teräs H, Curcher M (2020)Post-covid-19 education and education technology 'solutionism': a seller's market. *Postdigital Sci Educ* 2(3):863–878. https://doi.org/10.1007/s42438-020-00164-x

Tilak JBG (2020) Dilemmas in reforming higher education in India. *Higher Educ Future* 7(1):54–66. https://doi.org/10.1177/2347631119886417

Tinsley, B. (2020). Coronavirus and the impact on students in higher education in England: September to December 2020. *Office of National Statistics UK*, December, 1–16. https://www.ons.gov.uk/peoplepopulationandcommunity/educationandchildcare/articles/coronavirusandtheimpactonstudentsinhighereducationinenglandseptembertodecember2020/2020-12-21

UNESCO. (2015). *2015 Education for All Global Monitoring Report* (Issue May).

UNESCO. (2020). *2020 Global Education Meeting Extraordinary Session on Education post-COVID-19 Background document*.

van Wyk, M. M. (2020). Academic support under COVID-19 lockdown: what students think of online support e-tools in an ODeL course. *Interactive Technology and Smart Education*, 2020–2022. https://doi.org/10.1108/ITSE-08-2020-0121

Vega-Hernández MC, Alastrué JAG, Arsenal RM, Pérez JMP (2020) The impact of COVID-19 on teaching in statistics and operations research in higher education. *Boletin de Estadistica e Investigacion Operativa* 36(2)

Welsen, S., Pike, M., & Walker, J. (2020). Engineering student attitudes to e-reading in remote teaching environments. *2020 IFEES World Engineering Education Forum - Global Engineering Deans Council, WEEF-GEDC 2020*. https://doi.org/10.1109/WEEF-GEDC49885.2020.9293649

Yu, L., Huang, L., Tang, H., Hu, D., Feng, W., & Shi, L. (2020). *Analysis of factors influencing the network teaching effect of college students in a medical school during the COVID-19 epidemic*. 1–10.

Zhang Q, Zhou L, Xia J (2020) Impact of COVID-19 on emotional resilience and learning management of middle school students. *Med Sci Monit* 26:1–8. https://doi.org/10.12659/MSM.924994