Digital technology for facilitating inquiry-based learning during the COVID pandemic for human anatomy course

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Abstract:

BACKGROUND: Linking anatomy with the clinical approach for creating an inquisitive mind for a millennium via the digital platform is the need of the hour. Traditional lecturing makes students have rote memorization of the human anatomy. The inquiry-based project will allow undergraduate medical students to have a deeper understanding of human anatomy along with team building and interpersonal skill development. This approach of teaching would allow students to link the content taught for human anatomy with its clinical applicability and probably generate inquisitiveness for further exploring the course content. The study aimed to appraise and assess the perception of medical students and faculty about the inquiry-based digitalized project presentation.

MATERIALS AND METHODS: A descriptive cross-sectional study was conducted for inquiry-based project presentation where students were divided into 15 groups with 15 inquiries, which were presented as projects on a digital platform under the guidance of the facilitator. The perception of students and faculty for the inquiry-based approach was collected using a validated survey questionnaire. The quantitative data were analyzed by SPSS-version 15, using descriptive statistics, Friedman's rank, and thematic analysis for qualitative data.

RESULT: In total, 117 students participated in the pre-test and 129 in the post-test part of the study. Also, 79.1% of students appreciated that the inquiry-based project presentation approach allowed them to link anatomy with different courses; 73.6% agreed that this approach has a positive impact on their attitude toward learning anatomy. Then, 75.2% students appreciated of learning new skills using the digital platform. They agreed to have developed leadership (65.1%) and team-building skills (83.7%) and self-directed learning (SDL) improvement (71.3%). However, some students (9.3%) and faculty (16.7%) had been ostracized for presenting their inquiry-based projects on a digital platform, whereas 65.1% of students appreciated this approach.

CONCLUSION: Inquiry-based learning approach would allow students to have a deeper understanding of the subject knowledge and skills for the SDL and learn strategies for the usage of virtual technology for literature search.

Keywords:

Conceptual change, COVID-19, human anatomy, inquiry-based learning, online exchanges, online learning, pandemic

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Introduction

Researchers have defined inquiry-based learning using various definitions such as "a didactic principle in higher education that relies on student independence: learning by conducting their research."[1] This teaching and learning approach falls under the realm of "inductive" approaches encompassing a range of teaching methods including problem-solving, discovery-based learning, and many others.[2,3]

Inductive methods of teaching are characterized as:

- Student- or learner-centered approach[4,5] with a focus on students learning rather than the transmission of content by the teacher.
- Active learning is about learning by doing[5,6] that focuses on question–answer sessions, thinking in pairs or groups, and/or solving problems.[2]
- Self-directed learning skill development with a focus on students' self-responsibility to fulfill their learning gap.
- Creativity development with a focus to motivate the student to devise their approach to address the question/problem and come up with a well-structured outcome.[7]

Some of these inductive methods are being accomplished as collaborative group projects within or outside the formal curriculum.

The competency-based medical curriculum implemented by the National Medical Commission (NMC), earlier Medical Council of India (MCI), shows a pragmatic shift in the educational system placing the student in the center, whereas the teacher's role is transformed to the facilitator, allowing a student to be more independent, self-learner, and critical thinker. Teaching anatomy is something that always faces distinctive and contextual challenges.[8] Traditional didactic lecture with fewer interactive strategies makes the understanding of this anatomical topic tricky and difficult because students have to learn novel concepts with multifaceted terminology. This eventually makes the students memorize facts without understanding them.[9]

Student-originated projects in the dissection classes play a role in expanding students' learning by allowing them to venture into the self-directed approach, thus making their experience more meaningful.[10] Preparing a project with an inquiry-based approach by a group of students is an exercise in developing self-directed learning abilities. This activity will provide students an opportunity to work in a group develop interpersonal skills; maintain group dynamics and a team-building approach.[11] These approaches allow students to be creative and think out of the box.

A combination of inquiry-based learning via project preparation and presentation in a group probably aligns with constructivist theory in which knowledge is built upon personal experience. However, COVID-19 created a paradigm shift in the educational system (primary to higher education), globally. Thus, students' task of inquiry-based project presentation turned out to be a unique process. Here, the students need to use the digital platform to link with the group for discussing the inquiry. Further, they have to use the knowledge gained during in-class sessions, before COVID lockdown, for the topic associated with the inquiry, with strategies of literature search explained to the students. Finally, they had to prepare the project, as a group activity, in digital format for its presentation on the Zoom platform by the group. The use of the digital portal in itself was new to many of the students as well as some faculty members.

Thus, the study aims to appraise and assess the perception of medical students and faculty members about the inquiry-based digitalized project presentation as a learning tool for the anatomy course during the first year of an undergraduate medical program.

Materials and Methods

Study design and setting: A prospective, descriptive, cross-sectional questionnaire-based survey study was conducted to analyze the perception of inquiry-based digitalized project presentation as a learning tool for the anatomy course during the first year of an undergraduate medical program.

Study participants and sampling: All the 150 first-year medical students were divided into 15 groups by systematic purposive sampling procedure as per their serial numbers. A consent form was provided to the voluntary participants of the study. A random allocation of the faculty member from the department of anatomy was allocated as a facilitator during the process of project preparation and presentation.

Data collection tool and technique

Perception questionnaires scale for students and faculty were prepared via the Delphi technique where a panel of six experts comprising medical professionals (two within the institute and four outside the institute) were purposively sampled. Inclusion criteria for experts were the requirement of a postgraduate qualification with a minimum of 3 years of teaching experience. Each member was informed about the purpose of the study and verbally consented to participate in it. The content validity ratio (CVR) of each item of the student's perception questionnaire scale was 0.878 for 22 items and 0.798 for 6 items with the content validity index (CVI) of the scale as 0.85. Similarly, the CVR of each item of the faculty perception questionnaire scale was 0.878 for 25 items and 0.798 for 3 items with the CVI of the scale as 0.89.

The opinion of the first-year medical students was identified before introducing them to the inquiry-based project presentation. During an hour's session, the concept and ideas of preparing projects in the form of models from waste or bio-degradable material available

to them, three-dimensional (3D) digital formats, charts, and collages were explained. The concept of the group dynamic and team-building approach was explained, as it would help them to prepare the project as a team, within the group.

All the 15 groups selected an inquiry in the form of a clinical case scenario aligned with the anatomy topic via a lottery system. Each group had to discuss and understand the inquiry within the clinical case via an online platform (WhatsApp, Telegram, Google meet, etc.,). The students tried to analyze the inquiry as per the differential diagnosis and reach to probable diagnosis as per the clinical vintage provided. They finally identified the clinical issue and link it to the associated organ/organ system with its management protocol. Students were provided 30 days' timeframe to complete the project.

The participants' information sheet was provided and explained to students of the batch 2019–2020 and the faculty members.

Earlier students had to prepare and present their projects in the forms of physical models/3-D multimedia-based models/charts/collages, etc. Due to the COVID pandemic, students could not complete the project as planned. It was modified due to the prevailing condition after due approval from the ethical committee of the institute.

Students collaborated among themselves using the various online portals keeping the respective facilitator in the loop. Each group member contributed to the task that was visible to all due to digital connectivity. Schematics of the presentation were forwarded to the group leader for finalization. Each group was assigned a specific time slot for presenting their task to the class via the zoom platform. Each group was asked to be in contact with other facility members, other than their assigned facilitator, in case of need of doubt clarification or resources required for their project.

Each group presented their respective project presentation using multimedia in the of video/PowerPoint/animation, by a single member or including all the members of the group.

Responses of the students and faculty members were collected using the separate pre-validated Google form questionnaires.

Ethical consideration
The study was conducted after the approval from the Institutional Ethical Committee, PSMC, Karamsad (IEC/HMPCMCE/2019/Ex. 31/254/19).

Data analysis
The data were analyzed by SPSS-13, using an independent-samples *t*-test and rank test for the quantitative data, whereas qualitative data were deductively analyzed using Braun and Clarke's 6-step thematic analysis.[12]

Results

Perception of students about making of scientific model/project presentation before commencing of present anatomical science integrated model/project in a medical institute.

Out of 150 students, 117 submitted the response to the pre-survey questionnaire.

The responses by students to the pre-survey questionnaire [Table 1] showed that 83% agreed to have prior experience in scientific model making and 87% working in a group. The majority selected to have the experience to work with 5 to 10 members in a group with 50% considering to have good group work experience. Also, 66% of participants agreed to have conflicts within the group that they were able to tackle through discussion, mutual understanding, and other strategies.

The majority of participants liked the concept of using preparing scientific models for the process of learning as this method increased their peer interaction and had in-depth learning for the topic; helps in exploring numerous ideas to work on and with varied different experiences. However, a few had resentment mentioning that the process was very chaotic, with an increase in workload.

Student's perception of inquiry-based digitalized project presentation
The total number of students who participated in the study was 150.

The number of students who filled the perception feedback questionnaire was 129 (male = 71, female = 58).

The descriptive statistics for the post-session feedback questionnaire [Table 2] for inquiry-based digitalized project presentation in the department of anatomy. Friedman's ranking was the highest for item 4 "The clinical cases as an inquiry for project making were well selected by the faculties"; item-7 "I contributed to my best extent for project preparation and presentation"; item-9 "I was accountable for my work individually as well as for the teamwork"; and item-5 "I liked my inquiry topic for the activity." The lowest-ranked items were item 10 "Virtual or online or telephonic group discussions during the activity were a better way of learning"; item-28 "It

Table 1: Responses by students to the pre-survey questionnaire

Items	Response (N=117)	
Have you ever prepared a scientific model?	83% responded as Yes	
How would you like to work?	87.2%- Group; 12.8%- Independently	
How have you prepared a model, during school time?	94%- Group; 6%- Independently	
If you have prepared in the group, then how many members were in each group?		
Number of members in each group	Number of participants (N=117)	Percentage of participants
Less than 5 members	23	19.66%
5 to 10 members	86	73.50%
More than 10 members	01	0.86%
Independently	07	5.98%
How well did the group work?		
Good	59	50.43%
Better	20	17.09%
Best	26	22.22%
Not satisfactory	12	10.26%
Were there any conflicts within the group at any point in time?		65.8%-Yes; 34.2%- No
If, Yes, how you were able to manage it?		
By discussing with each other	There are the usual disagreement regarding how to proceed with the project, we use to take a vote	Majority wins
By always taking opinions from all not letting anyone become superior or anyone inferior		Mutual understanding
By discussing with the guide, teacher	With majority and logic	Yes definitely, had to explain to that member about the situation and then make them understand that what's best for the group is going to be done
I was the leader, so I helped communicate and create a bridge and a common understanding along with an emphasis on unity.	Talking to the mentor and sucking up	
	By discussing the problems and having an unbiased solution	Compromises make a group stronger.
By discussing it for a long time than coming to a different option	Ignore	By distribution of work equally among group members according to their strengths
By explaining to each other importance of group	Communication	We would come to a common conclusion and decision and then proceed, sometimes we would ask our guide to take a certain decision for us in case of conflicts
Chose the method of majority wins while trying to introduce the things the rest of them had to say about.	Making each other understand with calmness and no fighting	
Did you like this way of concept learning?		82.1%- Yes; 17.9%- No
If yes, how and if no, then why?		
Those who said YES to the above question	Those who said NO to the above question	
Because it is useful for us	No, because it's very chaotic work and can't be possible now to manage with the ongoing stuff.	
It increases our interaction and learning	Workload during hostel hours is something I don't like.	
By preparing the model on various topics if required we learn in-depth	Groups don't function well unless there is a basic understanding and compatibility. Usually, one passionate person does all the job and the others row the boat of credit. Working independently or in pairs is much better as the workload can be shared and it brings out more creativity as two minds are better than one. But too many of them lead to unnecessary confusion	
It was fun.		
Because it is very interesting and useful		
it will give a more clear understanding of any topic		
It can improve our understanding and also imagination power	Not everyone is willing to do her bit, or even contribute. The majority of work ends up on the shoulders of a few, but all get the credit	
It makes science more applicable	Don't like it, it indulges comparison, competition which increases the pressure	
Yes, it helps to learn better.		
You get to put many minds and work well.		
Very useful for long term memory		
It helps in exploring numerous ideas to work on and with many different experiences		
Yes it helps us to learn better		

was difficult to contact my group member due to the pandemic state"; and item-6 "I have a positive approach to working with peers online or telephonically."

A skewness statistic value shows negative values for all parameters signifying that there is a leftward shift in the graph. A Kurtosis statistic shows the value <3, that is, the graph is toward the flattened aspect.

Cronbach's alpha reliability statistics show a higher value for 28 questions of the post-presentation survey questionnaire (0.915).

Table 2: Descriptive statistics for students' post-session feedback questionnaire for inquiry-based digitalized project presentation showing Friedman's ranking for each item

S.No	Questions	Strongly Agree	Agree	No comments	Disagree	Strongly Disagree	Mean±SD	Friedman's rank
				Descriptive statistics with Friedman's Ranking for each item (N=129; male=71, female=58)				
1	Introduction for the inquiry-based digital project making was well explained by the faculty	43	69	14	2	1	4.17±0.74	07
2	The activity was clearly explained and well-organized.	41	72	12	2	2	4.15±0.77	08
3	I felt motivated to move on with this approach till the end of the presentation.	36	58	26	7	2	3.92±0.92	16
4	The clinical cases as an inquiry for project making were well selected by the faculties	62	52	15	0	0	4.36±0.68	01
5	I liked my inquiry topic for the activity	54	60	12	3	0	4.28±0.73	04
6	I have a positive approach to working with peers online or telephonically	18	41	43	21	6	3.34±1.06	26
7	I contributed to my best extent for project preparation and presentation	65	45	14	4	1	4.31±0.85	02
8	I tried to maintain an agreement and co-ordination among groups throughout the task completion	54	56	17	1	1	4.25±0.77	06
9	I was accountable for my work individually as well as for the teamwork.	60	52	13	4	0	4.3±0.78	03
10	Virtual or online or telephonic Group discussions during the activity were a better way of learning.	12	23	58	24	12	2.99±1.06	28
11	Team-based learning through this inquiry-based online activity helped me understand Anatomical topics in a better way.	31	43	27	18	10	3.52±1.22	24
12	I acquired additional information about the topic during a Team activity	47	61	16	4	1	4.16±0.82	09
13	The viewpoint of each group member was well heard and appreciated during the task completion.	36	71	20	2	0	4.09±0.7	11
14a	This learning approach helped me to develop the leadership skills	31	53	30	13	2	3.76±0.98	19
14b	If Yes, kindly specify two of those leadership skills developed:							
15	In case of any conflict over the idea for framing or presentation of the project, I now can find consensus for situations.	16	60	48	4	16	3.67±0.77	23
16	I learned to be flexible about making changes in the discussion group.	26	79	20	3	1	3.98±0.72	15
17	I am now able to sense the emotional undercurrents in my group.	24	59	36	9	1	3.74±0.87	20
18a	This study helped me to improve upon my self-directed learning (SDL).	41	51	28	7	2	3.95±0.95	14
18b	Kindly specify how your SDL improved by this method?							
19	Such an activity approach will also be beneficial for examination.	23	53	38	7	8	3.59±1.04	22
20	I liked the online presentation of the project with my group members.	33	51	33	8	4	3.78±1.0	18
21	Appropriate time was given to complete the task.	50	67	12	0	0	4.29±0.63	05
22	It reduced the amount of time needed for self-study.	15	45	50	14	5	3.40±0.96	25
23	The concepts learned during these sessions will be useful shortly too.	41	68	16	3	1	4.12±0.77	10
24	The activity allowed me to link different subjects with the anatomy course.	37	65	21	4	2	4.02±0.85	12
25	I think the real model/project presentation for the activity would have been better than the online presentation.	38	30	41	13	7	3.61±1.17	21
26	It had a positive impact on my attitude toward learning.	27	68	29	3	2	3.89±0.81	17
27	I learned a new skill of online presentation which will be helpful to me in near future.	39	58	24	6	2	3.98±0.89	13
28	It was difficult to contact my group member due to the pandemic state.	6	36	32	47	8	2.88±1.04	27

The statistical significance for items 1, 2, 3, 6, 7, 8, 10, 21, and 24 were observed as per gender variability, whereas no statistical significance was observed for other items.

The type of leadership skills participants developed during the activity and how they could improve upon their self-directed learning are presented in Table 3. The majority stated to have an improvement in their interpersonal attributes of communication, team-building, conflict management, and accountability.

The attributes that were enhanced for self-directed learning were time management, research skills, reading skills, search strategies, formulating their learning goals, and correlating the topic with its clinical applicability.

The response to the three open-ended questions under different themes is presented in Table 4 [Figure 1].

All the faculty members agreed that the inquiry-based project presentation was a good experience for students and the activity was clearly explained and well-organized (83.3%). All faculty members agreed that

the students felt happy to work on the assigned task and were accountable for their work individually as well as for the team.

Although 16.7% of faculties agreed that this approach of group discussion for this type of activity was a better way of learning. However, 83.3% of faculty agreed that students acquired additional information about the topic presented and develop group dynamics and leadership skills such as" *integrity, communication, public speaking, teamwork, nice plan to gather information,* and *presentation skill."*

All the faculty agreed that this newer approach helped students to improve upon their self-directed learning like"*… they collected information regarding their project.";* "*… focused learning activity related to their task…."*

All faculty members agreed that the online presence of their group activity allowed students to link different subjects with the anatomy course. However, 50% disagreed that it was difficult for group members to contact facilitators due to the pandemic state.

Table 3: What leadership skills did students develop during the project activity and how did they improve their Self-directed learning (SDL) approach

Leadership skills developed	SDL improved by this method
Confidence	Ability to manage learning tasks and learn about time management
Getting the different opinions together	Detailed research was needed to propose precise information for the case.
Listening skill	It made me read and understand my topic as well as other groups
Co-ordination, work distribution	Formulating learning goals, taking initiative
Making all the people work and more importantly together	Learning to search for topics allotted to me within the specified time frame
Taking a responsibility for coordinating with the teachers	By making anatomy fun. By not sticking to conventional methods
Dealing with people of different nature	We solved the case ourselves and we found according to that case clinical aspect
Distribution of work to individual	It is improved by researching on given case & related aspects by understanding it through various pathways.
Conflict management	
Communication	I looked up pathology videos, Obstetrics & Gynaecology reference guides, and radiology resources too which I probably never would have in the first year.
Acceptance of ideas of others	
Integrity, relationship building	Yes, because in this case given to us we have to find the proper diagnosis and related anatomy.
Improved my knowledge regarding the topic	
Strategic thinking, planning, and delivery-	We were encouraged to correlate it with the clinical case and other subjects of MBBS. Also, used the internet extensively while getting doubts regarding the content which may or may not have arisen otherwise. Clearing self-made doubts that I may have on a particular topic.
Encouraging others	
Learned planning the project in a well-organized way	
Taking responsibility	I googled for lots of extra information and I learned a lot of stuff not mentioned in the textbook
Being accountable to the task	
Open mind thinking	I needed to do an extra effort and fetch some more information from different resources and during the process, my concept got more clarity
To contribute and validate my content effectively with consent	To be honest, although our teachers encouraged us to follow the path of self-directed learning, I was never able to realize neither its value nor its full potential. But after this activity, I finally understood that self-directed learning is an enlightening journey in which a lot of knowledge can be gained in a short period which is not tiring and also helps to study the subject in-depth.
Make members hold responsible for the given task	
Able to give constructive criticism to group members	
Take feedback on the task	
Manage a time	I can search for more things about the topics by myself
Delegate	Deep learning about each topic
	Clinical correlation of every topic in a better-organized way makes me have more interest in that particular aspect
	It got me to know how to do focused research on the internet

Table 4: Participant's responses as per number (P-Number) to qualitative open-ended questions

What did you appreciate or enjoyed most during this activity session?
Responses for the above question were could identify three themes:

Learning of the clinical aspect:	"I enjoyed learning the clinical aspects in this way" (P12)
	"Listening to the presentation of each group was a good learning experience" (P34)
	"Learning about 15 different cases and their correlation with our subjects and concepts taught was great" (P37)
	"I learned the details, signs and symptoms, treatment, etc., for the case and then compiling and presenting."(P64)
	"Get to know different concepts related to the allotted cases" (P92)
	"Putting the entire funda related to the case in one presentation, was an amazing experience as a learner." (P105)
	"I enjoyed the interaction with the teachers and learning better ways to present the case, also the format to proceed towards a better diagnosis, idea of differential diagnosis was learned during this journey…." (P118)
Use of varied resources:	"The research for a topic from various sources…." (P14)
	"I got to know some information which wasn't available in given books" (P46)
	"Researching and learning beyond the textbook and understanding of anatomy" (P72)
	"Use of Google for searching about the content/details related to the case" (P108)
Better inter-activeness:	"Discussing new ideas with co-members was great" (P2)
	"Information, question-answer session, feedback from the faculty which help improve our skill" (P59)
	"Appreciation from teachers gave confidence to our group" (P76)
	"Feedback and it helped to improve our knowledge for the topic being discussed" (P86)
	"Communication and innovative ideas from different members of the group" (P95)
	"Coordinated peer learning" (P104)
	"I learn how to solve issues during group discussions myself." (P107)
	"Improving the self-directed learning skills" (P117)
	"Concepts explained by our colleagues in new & interesting ways…" (P120)
	"Teamwork and co-ordination with fellow team members." (P123)

Do you think this program requires any further improvement? If yes, kindly specify.
96 participants suggested - no improvement required
The suggestions from participants were divided under three themes:

Technology development:	"Webex consumes lots of data and even causing the problem to connect with the session." (P12)
	"Taught us online presentation skills" (P66)
	"I feel that when someone is presenting, others shouldn't be allowed to unmute themselves, even though all the cases of it were unintentional." (P85)
Accountability:	"Accountability of group members should be emphasized more" (P23)
	"Not all group members participated, there were a few who took all of the responsibility on themselves…" (P67)
	"Group members should be more responsible. They should show some interest and also contribute to the project." (P73)
Group division:	"More no. of students should be allowed to participate than only one presenter" (P34)
	"If the teachers coordinate and supervise the topic distribution and presentation progress, this will reduce the burden on the responsible members in the group" (P65)
	"Have smaller groups so there's more work for everyone…" (P70)
	"Compulsions on each members contribution" (P86)
	"All the people in the group are not going to work as they will sit on the shoulders of the person who will be doing all the work to come forward." (P101)
	"The teacher assigned to us showed no response in our project." (P101)
	"….the presentations could be told to be more interactive wherein other students provide their input as well, and if there was a possibility of having a slight competition, it would have pushed the teams to put it in more effort" (P119)

How do you feel about the change in the presentation of your project due to the COVID-19 pandemic?
79 participants liked this modification of the presentation due to COVID-19

Endorsed:	" ….but then proper guidance by our allotted teacher and everyone's hard work could make it happen." (P12)
	"….more helpful than the model making coz we griped more knowledge than making a waste of our time on the artwork" (P35)
	"…it was a super cool activity. I loved it and appreciate the efforts of each one involved in this act…" (P52)
	"It went good due to involvement of technology" (P78)
	"…very helpful and improved our online learning skills" (P88)
	"Online presentation gave us a varied experience, on the contrary, the traditional methods" (P116)
	"Nice work done by our faculties to give us such a great opportunity for these presentations." (P123)

Contd...

Table 4: Contd...

How do you feel about the change in the presentation of your project due to the COVID-19 pandemic? 79 participants liked this modification of the presentation due to COVID-19

Ostracized: "….as most of us were far away.not easy to contact, and prepare along with the contribution of all the members…." (P7)

"….interacting with the fellow members of the group was reduced" (P28)

"….we didn't have any books related to our topic so from where we'll gather the information" (P39)

"….presenting in front of 150 students and the faculty members. doing that would have tested our confidence and skills to the ultimate level, also we would have been conscious about our mistakes." (P66)

"…the lack of interpersonal communication allowed some members to slack." (P70)

"….it reduced accountability of every member in the group as only the leader and 2-3 members were concerned,…." (82)

"…group mates made end time declaration of nonavailability of technology, while the ppts can be easily made on plain smartphones with fewer efforts" (P91)

"We were ready with a 3-D model of our project…" (P122)

"Like it could be better if it's offline so all the members can able to participate to represent and also we can represent a model which may improve our work." (P129)
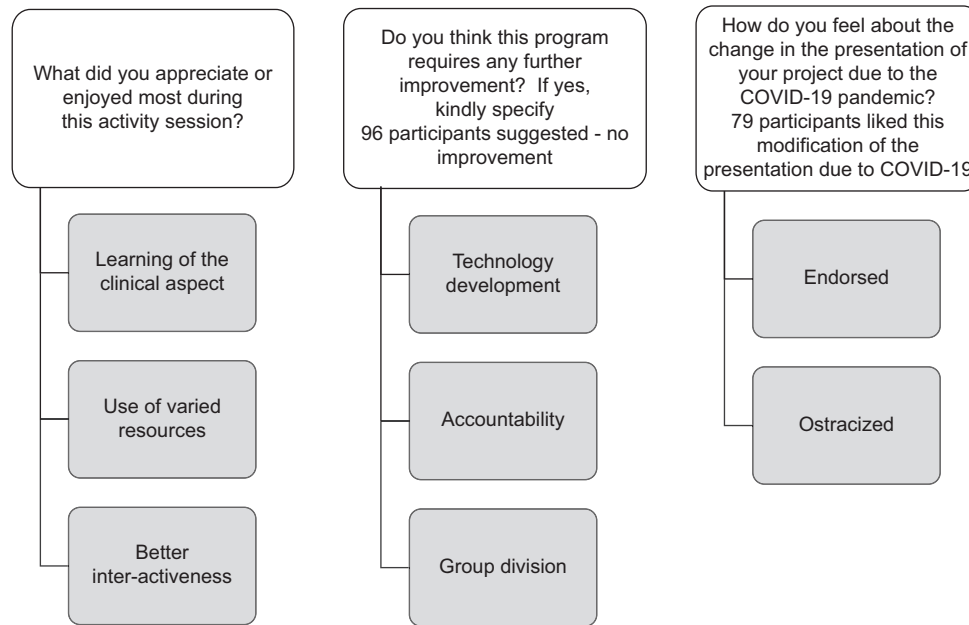

Figure 1: Student's response to three open-ended questions

Faculty feedback

Faculty suggestions in terms of improvement in study methodology were *"More involvement of faculty"; "…students should also have to practice to make their presentation better online"; "Model base presentation is more helpful"; "… better-defined roles of the group members along with their roles and responsibility and presentations among the small group before going for final presentation"; "more focus on anatomical aspect by students"; "better communication between teacher and students required so that students presentation improve".*

Faculty perception for modification in presentation mode due to the COVID-19 pandemic was *"It was good and feasible change both for faculty and students", "face-to-face contact with the students for their presentation and project could yield better results and ensure active contribution from all the members", "I think model presentation is more effective than online presentation", "overall change in format was justified seeing the COVID situation", "It was a good experience, students have worked hard and tried to give their best".*

Faculty input as per their appreciation/enjoyment during the activity was "student's best efforts in the current situation", "students teamwork and presentation", and "I enjoyed the clinical correlation of each case."

Discussion

The COVID pandemic has transformed every aspect of human life including educational curricular implementation strategies. However, it will take a long time for us to accept the change and make the digital platform one of the modes for teaching-learning and assessment. The outcome of this research is promising as per students' opinion for introducing inquiry-based project presentations by first-year medical students in

the department of anatomy. Still, the majority of students and faculty suggested having these presentations as face-to-face rather than on an absolute digital platform. Even after 20 months of using digital technology in the field of education, it is still difficult to accept this technology wholeheartedly.

In our study, the students agreed that inquiry-initiated project-based learning improves the understanding of the topic and enhances team-building, quality of leadership, and self-directed learning approach within them. The results are aligned with the reports of Pamplona *et al.*,[10] who concluded that students had a positive learning gain through the model-making project in terms of the four learning domains. A significant relationship was found between the profile of the respondents and their assessments of the learning gains.

This inquiry-based learning approach, at a stretch, leads to cognitive gain other than enhancement in affective domain skills and approach to self-directed learning, using digital portals. Moreover, sensitizing students in different formats to present proposed inquiries for the course would have improved the outcome of the research study.

The study by Vesikivi *et al.*[11] based on a project-based curriculum showed an improvement in the retention rate compared to previous years with an increase in the student's satisfaction with collaborative and independent working for boosting learning in project teams. Similar results were concluded by other researchers.[13-18]

Although some researchers such as Dixit *et al.*[9] concluded that a low-cost learning intervention formulated to deliver a complex 3D model of tracts passing through various parts of the nervous system by simple materials would show better access and understanding of the tracts with an improvement of 3D visualization skills.[9-11,13-19]

In spite of having mixed feelings about online presentations among students and faculty members, the majority of students agreed to have acquired additional information about the topic, with improvement in self-directed learning approach and soft skill development. In addition, students also enhanced their virtual digital skills, which is the need of the hour.

Having acceptance of a digital platform for the inquiry-based approach of teaching-learning by 50% of the participants, the rest of the participants mentioned the limitation of this type of activity. Some students stated limitations such as decreased network connectivity, absence of physical presence to view the non-verbal communications either during the group task or presentation, and limited knowledge about the

various computer tools that restricted their creative ideas to be presented on the digital platform. Even faculties specified that face-to-face presentation would have been much better than online specifically in terms of giving feedback.

Some of the researchers in their study specified how the medical education curriculum adopted the digital platforms for both asynchronous and synchronous group learning during the COVID pandemic state.[20,21] Several innovative medical educational opportunities were explored and implemented by the educators in the field of teaching-learning, assessment, patient dealing via triage, and many more. Some worked well, whereas a few needed further modifications.[21,22] However, a study by Alkhowailed *et al*.[23] specified that the role of informatics computer technologies during the pandemic promoted the students, research skills, and technical competencies other than facilitated the performance of the students with sharing of knowledge by peers.[23] The study by Bhat *et al*.[24] showed cognitive gain and receptive perception for e-learning in the department of anatomy for medical students.[24]

"The greatest discovery of all time is that a person can **change** his future by merely **changing** his attitude"– Oprah Winfrey.

Limitations and recommendations
It will be difficult to generalize the results because the study cannot ensure that every student of the study has attained the attributional qualities of the same level. For this facilitator assessment, self-assessment and peer-assessment scoring would probably be helpful. Secondly, there is a need for training faculty members for preparing integrated inquiry-based clinical cases/problems. Lastly, there is also a need to sensitize students to group dynamics and prepare 3D anatomical models and digital presentations. This probably would have further enhanced their focus on the activity despite being far apart.

There is a need to provide training sessions for faculty first then for students so that they will be well versed in the use of skilled lab, which is now a mandatory guideline as per the National Medical Commission (NMC).

Conclusion

The study concurs with the literature on inquiry-based digital projects, in terms of increasing students' acceptance of its use in the course curriculum and allowing them to link basic science with its clinical approach. It encourages them to improve upon their e-learning skills and enhance their creativity while presenting their projects on a digital platform. Additionally, it also augments their soft skills

such as leadership, collaboration, and a team-building approach.

The use of digital platforms primarily will guide students in doing search strategies for having self-directed learning that will make them lifelong learners. Secondly, these will benefit them to be better researchers by having appropriate skills to do the literature search for the research topic.

Conflicts of interest
There are no conflicts of interest.

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