

# Enhancing the Embryology teaching-learning experience in the medical curriculum: a faculty & student lookout

Sushma Prabhath<sup>1</sup>, Suhani Sumalatha<sup>1</sup>, Ashwija Shetty<sup>1</sup>, Kumar MR Bhat<sup>2</sup>

<sup>1</sup> Department of Anatomy, Kasturba Medical College Manipal, Manipal Academy of Higher Education, Manipal, India

<sup>2</sup> Department of Anatomy, Ras Al Khaimah College of Medical Sciences, RAK Medical & Health Sciences University, Ras Al Khaimah, UAE

## SUMMARY

It has been identified that most medical students are dissatisfied with current embryology teaching, and they often find embryology learning difficult. The present study was conducted to evaluate the perception of faculty and undergraduate medical students regarding the existing teaching-learning practices in embryology. The present cross-sectional study involved faculty, undergraduate, and postgraduate students engaged in embryology teaching-learning. The study was conducted in two steps. In the first step, the undergraduates were provided with a semi-structured questionnaire that addressed the practices of embryology teaching-learning in the current medical curriculum. The responses were recorded using a Likert scale. In the second step, the participants were invited to answer an open-ended question on improving the teaching-learning practices of embryology. The study involved 50 faculty, 232 medical undergraduates, and 15 postgraduate students. Most participants (76.1%) agreed that human embryology is essential in understanding anatomical variations, congenital anomalies, and clinical ailments.

Although embryology is interesting to study, it is not easy to comprehend, as stated by most students (52.24%). They also felt that embryology is often neglected while learning Anatomy (70.73%). Ways to improve the embryology teaching-learning practices assessed in step two identified the following themes: image and video-assisted learning, experiential learning, 3D-models assisted learning, case-based learning, specimen-based learning, assessment-based learning, and small-group teaching. Embryology teaching-learning is an integral part of the Anatomy curriculum. Therefore, there is a need to reform the existing methodologies of embryology teaching-learning to enhance student engagement. Seeking students and faculty's perceptions about the current practices of embryology teaching and its impact on their learning becomes useful. This study intends to utilize the feedback gained in improving the process of imparting embryology knowledge and will assist in a positive learning experience for the students.

## Corresponding author:

Dr. Suhani Sumalatha, Associate Professor. Department of Anatomy, Kasturba Medical College, Manipal, Centre for Basic Sciences, First Floor, Manipal Academy of Higher Education, 576104 Manipal, India. Phone: +91-820-2922327 (Office); Fax: +91-820-2570061. E-mail: suhani.s@manipal.edu

Submitted: October 20, 2022. Accepted: December 12, 2022

<https://doi.org/10.52083/PDWD6678>

**Key words:** Embryology – Teaching-learning – Medical curriculum – Perceptions – Students – Faculty

## INTRODUCTION

Human Embryology is integral to basic science teaching in the medical curriculum. Understanding the mechanisms and causes of the embryo's normal and abnormal development is essential. In addition to exploring the incredible process of making a human being also provides a better orientation of gross anatomy to medical students. The knowledge (learning outcome) of embryology also finds its applications in various fields of Medicine, such as surgery, pediatrics, obstetrics, and gynecology (Moxham et al., 2016; Dinsmore et al., 1999). Further, as infertility is a growing problem in the current generation, it also enables the students to stay abreast with the recent advances in in-vitro fertilization, embryo implantation, and cryopreservation of embryos. Interestingly, embryonic stem cells are gaining importance in treating various diseases. The knowledge of embryology is also helpful in dealing with stem cells and cloning (Hamilton and Carachi, 2014; Aversi-Ferreira et al., 2012; Carlson, 2002; Vermeulen et al., 2019).

Students often find embryology challenging to understand and tend to lose interest in its learning. The method of imparting embryology knowledge to the student could be one of the reasons.

The traditional teaching method believes that the didactic lecture is the most effective method for conveying information to the student (Butler, 1992). Most medical colleges in India teach embryology using blackboard or PowerPoint presentations. As embryology is a dynamic subject, these teaching modalities may fail to give a 3D orientation of the embryo/embryogenesis to medical students in their early years of learning. Therefore, the students find it challenging to understand and comprehend the concepts. They may even fail to reproduce the same in their assessments (Aversi-Ferreira et al., 2012; Halasz, 1999). Thus, embryology is often neglected from the curriculum by most students.

Implementing the Competency-Based Medical Curriculum (CBME) by the National Medical

Council (NMC) of India has shifted the focus from traditional didactic lectures to self-directed learning or a flipped classroom approach. Different modalities of small group teaching/learning and hybrid learning modes have evolved since (UG Curriculum-NMC, 2021; Kerdijk et al., 2013). It has further warranted a revision and reformation in teaching-learning (T/L) practices in anatomy, including embryology.

The students' and faculty's perceptions and viewpoints are paramount while revising the T/L practices and exploring the methodologies best suited for embryology (Jaiswal et al., 2015).

Therefore, the present study aims to seek the perceptions of medical undergraduate, postgraduate students, and the faculty in Anatomy about embryology T/L practices. The feedback obtained can be utilized to improve the embryology T/L experience for the students.

## MATERIALS AND METHODS

The present cross-sectional study was carried out in the year 2021. It included undergraduate (both first and senior years) students, anatomy postgraduates, and faculty involved in embryology teaching-learning. The undergraduate students of senior years were engaged in embryology learning in their first professional year. All the students were exposed to the same teaching-learning methods during their embryology teaching-learning sessions. The students were exposed to didactic lectures, small group discussions using embryology models, video-based and case-based learning sessions.

The Institutional Ethics Committee approved the study. All the participants were allowed to participate or decline participation in the study. Informed consent was taken from the participants who agreed to participate in the study.

A two-step approach was followed in conducting the study.

### Step 1:

In step 1, the undergraduate (including only first-year) students who willingly consented to participate in the study were given a close-end-

ed structured questionnaire (Annexure 1). The questionnaire components addressed the current practices of embryology teaching and its impact on their learning. The questionnaire was administered online through Microsoft teams (Microsoft, One Microsoft Way, Redmond, Washington, U.S.).

### Data analysis: Quantitative analysis

The responses to the close-ended questions were recorded using a Likert scale (1-5: strongly disagree-strongly agree). Some of the close-ended questions also had 'yes,' 'no,' and 'don't know/may be' types of responses. The results were expressed in frequency and percentages. Paired

**Annexure 1.** Questionnaire on the first-year undergraduate student's perception of the current practices of embryology teaching and its impact on their learning.

	Strongly agree(%)	Agree	Neutral	Disagree	Strongly disagree
Human embryology is essential in understanding gross anatomy					
The current syllabus of embryology is relevant for acquiring knowledge					
The study of human embryology is an important and necessary part of medical training					
Knowledge of human embryology is essential in understanding other subjects such as physiology, medicine, surgery, obstetrics, Pediatrics, etc					
Knowledge of human embryology helps me to better understand certain clinical ailments better					
Knowledge of human embryology is essential in understanding gross anatomy					
The lessons learnt in human embryology can be used practically as a health care professional					
I find the subject of human embryology interesting					
I find the subject of human embryology difficult to understand					
Embryology should go hand in hand with the relevant topics in gross anatomy.					
Teaching more slowly (i.e., at a slow pace) than the other gross anatomy lectures helps me follow embryology better					
The concepts of embryology taught in the lecture classes are adequate and understandable					
I find answering exam questions on human embryology more stressful than answering those on gross anatomy topics					
I personally would like to have more human embryology incorporated into the anatomy lab (more demonstration sessions)					
I personally would prefer to not be required to learn human embryology in medical school					
The concepts of embryology taught in the lecture classes are adequate and understandable					
	<b>Yes</b>		<b>No</b>	<b>Don't know/may be</b>	
Are you satisfied with the present time allotted to teach embryology in the current CBME curriculum?					
Small group teaching is required to understand embryology					
Do you feel embryology is often neglected while learning Anatomy?					
Given the amount of reading embryology requires, do you feel the percentage of marks allotted for embryology in the examinations is sufficient?					

T-test was used to compare the differences in the observations between the male and female undergraduate students.

## Step 2

In step 2, we extended the study to all participants. In this step, the undergraduate (including first and senior-year students), postgraduate students, and faculty of anatomy were involved. The faculty engaged in teaching embryology with an average teaching experience of 8-30 years were considered. The study participants were invited to answer an open-ended question. Herein the participants were encouraged to opine on the measures required to improve the teaching-learning practices of embryology.

### Data analysis: Qualitative analysis

The responses to the open-ended question were reviewed and subjected to qualitative analysis, and themes were identified. Thematic analysis was performed. The authors coded the material after reading and rereading the participants' replies. The codes were then examined to find the pattern, and the themes were identified. An inductive and semantic technique was used.

## RESULTS

The present cross-sectional study involved the following:

**Step 1:** 222 first-year medical undergraduates (108 male and 119 females)

**Step 2:** 222 first-year medical undergraduates (108 male and 119 females), ten senior undergraduates (8 males and two females), five anatomy postgraduate (one male and four females) students, and forty faculty members (11 males and 30 females) in anatomy. The faculty involved in teaching embryology, with an average teaching experience of 8-30 years, were considered.

### Step 1: First-year undergraduate students (N=222) perception of the current practices of embryology teaching and its impact on their learning

The fact that the knowledge of human embryology is essential in understanding gross anatomy

was agreed upon by 67% of the study participants. Nearly 11% of the participants disagreed with this fact, and 21 % were neutral.

Most of the study participants agreed that the current syllabus of embryology is relevant for acquiring knowledge (69%). The same was disagreed by 9% of the participants, while 22% were neutral.

The rest of the responses to the close-ended questions are presented in table 1. Paired T-test revealed no significant difference between the observations in males and females.

When asked about the T/L methods suitable for embryology, the following were the collective responses obtained:

- Lecture class with blackboard teaching: 22.6%
- Lecture class with PowerPoint presentations (PPTs): 29.2%
- Lecture class with models/ videos: 73.9%
- Case scenario-based learning (problem-based learning): 32.7%
- Small group teaching: 42%

When asked to specify the other options available, the following were the responses obtained:

Use original fetal specimens, clay models, animation-based learning, and embryology learning videos incorporated into PPTs.

### Step 2: Participants' views on the measures required to improve the T/L practices of embryology

Step 2 involved 222 first-year medical undergraduates (108 males and 119 females), ten senior undergraduates (eight males and two females), fifteen anatomy postgraduate (11 males and four females) students, and forty faculty members (11 males and 30 females) in anatomy.

The response to the open-ended question 'how can embryology T/L be made more interesting and effective in the current CBME curriculum' was reviewed. The themes identified are presented in table 2.

**Table 1.** First-year undergraduate student's perception of the current practices of embryology teaching and its impact on their learning.

	Strongly agree (%)	Agree	Neutral	Disagree	Strongly disagree
The study of human embryology is an important and necessary part of medical training	53(23.87)	120(54.05)	41(18.46)	8(3.6)	4(1.8)
Knowledge of human embryology is essential in understanding other subjects such as physiology, Medicine, surgery, obstetrics, Pediatrics etc	26(11.71)	81(36.48)	81(36.48)	28(12.61)	10(4.5)
Knowledge of human embryology helps me to understand certain clinical ailments better	48(21.62)	124(55.85)	43(19.36)	6(2.7)	5(2.2)
Knowledge of human embryology is essential in understanding gross anatomy	39(17.56)	113(50.90)	47(21.17)	20(9.0)	7(3.15)
The lessons learned in human embryology can be used practically as a healthcare professional	22(9.90)	79(35.58)	92(41.44)	22(9.90)	11(4.95)
The concepts of embryology taught in the lecture classes are adequate and understandable	19(8.55)	107(48.19)	67(30.18)	24(10.81)	9(4.05)
I find the subject of human embryology interesting	30(13.51)	82(36.93)	60(27.02)	37(16.66)	17(7.65)
I find the subject of human embryology difficult to understand	37(16.66)	79(35.58)	66(29.72)	34(15.31)	10(4.50)
I find answering exam questions on human embryology more stressful than answering those on gross anatomy topics	35(15.9)	107(47.7)	35(15.9)	30(13.6)	15(6.8)
I study only a few selected topics in embryology from an examination point of view rather than the entire syllabus.	80(36.4)	97(43.2)	20(9.1)	10(4.5)	15(6.8)
I would prefer not to be required to learn human embryology in medical school	11(4.95)	21(9.45)	53(23.87)	104(46.84)	37(16.66)
Embryology should go hand in hand with the relevant topics in gross anatomy.	73(32.88)	116(52.25)	25(11.26)	8(3.60)	4(1.80)
Teaching more slowly (i.e., at a slow pace) than the other gross anatomy lectures helps me follow embryology better	43(19.36)	91(40.99)	56(25.22)	24(10.81)	11(4.95)
I would like to have more human embryology incorporated into the anatomy lab (more demonstration sessions)	45(20.27)	91(40.99)	60(27.02)	18(8.10)	12(5.40)
		<b>Yes</b>	<b>No</b>	<b>Don't know/Maybe</b>	
Are you satisfied with the time allotted to teach embryology in the current CBME curriculum?	81(36.48%)	95 (42.79%)	50(22.52)		
Small group teaching is required to understand embryology	169(76.12)	23(10.36)	34(15.31)		
Is embryology often neglected while learning Anatomy?	157(70.72)	31(13.96)	36(16.21)		
Given the amount of reading embryology requires, is the percentage of marks allotted for embryology in the examinations sufficient?	155(69.81)	43(19.36)	28(12.61)		

## DISCUSSION

The present study reiterates that the knowledge of human embryology is essential for understanding the basic concepts of Anatomy. Being an integral part of the anatomy, understanding the intricacy and notion of the organization of the human body requires knowledge of fundamental pre-clinical medical topics such as embryology. Further, it also aids in providing a proper understanding of physiological and pathological processes, both normal and abnormal occurring in

different diseases or disorders of the human body (Zaletel et al., 2016). Student responses recorded in the current study have documented the same.

Although embryology is interesting to study, it is challenging to comprehend, as stated by most students (52.24%) in the current study. Studies in the past also opined the same. They further added that many students find it challenging to see and comprehend embryology and to understand and reproduce it in a theory exam (Moraes and Pereira, 2010).

**Table 2.** Participant responses on 'how can embryology teaching-learning be made more interesting and effective in the current CBME curriculum' and the themes identified.

Quote	Theme
<p>"With animated pictures and videos of the events occurring. Also, by including the embryology models in teaching" <b>(First year undergraduate 1)</b></p> <p>"Embryology teaching- learning can be made more interesting in CBME curriculum by using 3D teaching videos. Such videos help students to grasp faster and to make learning easier" <b>(Postgraduate 1)</b></p> <p>"Chalk and board explanation mainly and assisted by schematic videos and clinical pictures is helpful" <b>(Senior undergraduate student 1)</b></p>	Image and Video assisted learning
<p>"First of all, you have to take the students to an imaginary world where they visualize the entire events. More use of picture sequences. Animated videos are the most important teaching aids in learning embryology. First round of teaching should be very simple sequences. Once they understand the simple sequences then add details. We need to prepare simple flow charts either with words or with diagrams - as flash cards to revise the embryology" <b>(Faculty 1)</b></p> <p>"Teaching it at a slower pace compared to the current pace as it is very interesting subject which is made disinteresting by the current teaching pace" <b>(First year undergraduate student 2)</b></p>	Experiential learning
<p>"Use of more videos and 3D models rather than passive descriptive lectures. Visualization of structures makes learning and understanding better. Digital 3D models being made available or resources for such being made aware among students" <b>(Faculty 2)</b></p>	3D models assisted learning
<p>"Real life photos of anomalies and it's cause, case-based discussions, models making can be activity and explaining those to their peers as an exhibit may help them remember very well" <b>(Faculty 3)</b></p>	Case based learning
<p>"Embryology is the subject in which more specimen learning helps rather than theory lectures. What I believe is that for embryo, specimen and diagrams are very important to know better than just mug it up" <b>(First year undergraduate student 3)</b></p> <p>"Showing them live demonstration in clinical embryology department. Zebra fish embryos are transparent and can be used as an interesting tool for explaining" <b>(Faculty 4)</b></p>	Specimen based learning
<p>"Small part to be covered in a single lecture. Use of videos, 3D models to explain facts. Reinforcement of the lectures in small group. Assessment drives learning. so, quizzes can be conducted. Model and chart making competition can be conducted" <b>(Faculty 5)</b></p>	Assessment-based learning
<p>"Small group discussion is helpful. As per CBME, ECE sessions with cases of congenital abnormalities, then a description of the basic science will help. Use of models concomitantly will increase the understanding." <b>(Faculty 6)</b></p>	Small group teaching

The present study also observed that the students found answering exam questions on human embryology more stressful than answering those on gross anatomy topics (63.6%).

Since the subject is given such little weight in theoretical tests, most students typically only focus on a few topics from an exam perspective. Very few students fully grasp the subject and its application in the clinical field (Morales and Pereira, 2010).

Similar observations were made in the current study, with nearly 79.6% vouching that they study only a few selected topics in embryology from an examination point of view rather than the entire syllabus. It is because the weightage of the embryology content was less compared to the gross anatomy topics in the theory examinations. Therefore, the students tend to study only a few selected topics in embryology from an examination point of view, and some others just skip the subject altogether.

Although embryology learning is complex, students still find it highly relevant. Only a tiny percentage of the students prefer not to be required to learn human embryology in medical school (14.4%). It further evokes the need to explore the measures that would make embryology teaching-learning exciting and easy for the students.

As a remedy to permit an easy understanding of topics in embryology, most students opined that embryology should go hand-in-hand with the relevant topics in gross anatomy (85.13%). Students also preferred incorporating more human embryology topics into the anatomy lab/demonstration sessions for better understanding (61.26%). It was also found that teaching embryology slowly compared to the other gross anatomy topics helped to follow the concepts better (60.35%).

However, when asked whether the students were satisfied with the present time allotted to teach embryology in the current CBME curriculum, 36.48% agreed, and 42.79% denied. The remaining 22.52% were neutral.

Previously it has been claimed that it is possible to cover the entire embryology curriculum for undergraduates in two hours with successful results. But this observation is highly subjective, controversial, and impossible to adapt to the current scenario (Kazzazi and Bartlett, 2017).

Students find studying embryology frustrating because of the short teaching hours and difficulty of the subject. According to reports, medical students find learning about embryology complex and lack confidence in understanding. Additionally, they believe it was poorly taught to them during their college studies (Hamilton and Carachi, 2014; Scott et al., 2013).

It could also be one of the reasons for the students feel that embryology is often neglected while learning Anatomy (70.73%). Students also opined that given the amount of reading embryology requires, the percentage of marks allotted for embryology in the examinations is not sufficient (89.17%)

The impact of severely limited hours of embryology teaching on students' understanding warrants further research. Additionally, newer measures need to be taken to implement effective embryology teaching-learning practices in a restricted time frame and make them more inclusive in Anatomy learning.

Demonstrating fast, three-dimensional changes occurring macroscopically and microscopically has always been challenging in embryology teaching (Morales and Pereira, 2010). Therefore, there is a need to identify and implement appropriate teaching-learning methods to improve the understanding of embryology.

Lecture classes incorporated with embryology models and videos (73.9%) and small group teaching (42%) were identified as good teaching-learning methods for embryology in the current study. Exploration of how to improve the embryology teaching-learning practices revealed the following themes: image and video-assisted learning, experiential learning, 3D models assisted learning, case-based learning, specimen-based learning, assessment-based learning, and small group teaching.

According to the conventional teaching method, the most effective method for conveying information to students is through a didactic lecture. However, it needs to provide adequate time for more profound learning activities (Al-Neklawy, 2017).

A study in the past revealed that didactic lectures were least preferred (32.8%) in learning. On the contrary, the students liked video lectures (41%) to learn and understand rare signs and cases (Papanna et al., 2013).

Some universities have practiced collecting clinical histories with pertinent pictures and videos, applying this method to impart embryology, and using photographs of newborns with abnormal embryos. Using images of normal and abnormal embryos, fetuses, and newborns helps people comprehend the issues being discussed (Morales and Pereira, 2010). Specimen-based learning also adds to it.

When taught using clinical examples and management in instruction, embryology helped students comprehend and apply the ideas. It further elevated their level of satisfaction (Scott et al., 2013). It was also found that including clinically oriented multiple-choice questions (MCQs) at the end of the class was helpful (Hasan et al., 2018). It was also found that two-phased teaching would be highly beneficial. In this model, the basics of embryology are taught in the class, and their relation to clinical cases and scenarios would be introduced in the clinical setting, i.e., pediatric/neonatal surgery units of the hospitals (Hasan et al., 2018).

It would be an advancement in teaching techniques to use three-dimensional models and multimedia to assist students in visualizing the changes and processes within fetuses (Koscinski et al., 2019). It helps in experiential learning, as observed in the present study.

Studies have opined that the association of complementary pedagogic methods with movies and drawings related to embryology permits the optimization of embryo teaching (Koscinski et al., 2019). The present study also stated that such practices' association with routine didactic lectures could make embryology teaching learning effective and further enhance student engagement.

Previous studies have also affirmed that learning embryology through model construction is more effective than traditional embryology teaching (Aversí-Ferreira et al., 2012).

It is also observed that the creation of models encourages active learning and gives students a 3D perspective of different dynamic developmental changes in embryology with high recall memory. Materials such as play dough were stated as excellent materials for model construction (Patil, 2020). Similar observations were made in the current study.

Assessment is a central feature of teaching and the curriculum. It is one of the most potent influences/methods to assess the student's learning experience (Liu and Carless, 2006). Including more formative assessments in the form of quizzes and poster/model-making competitions can enhance embryology learning, as suggested in the present study.

A medical student's weight assigned to a subject in the overall evaluation plan has a direct impact on how motivated oneself to study that subject (Wormald et al., 2009). Considering the relevance of embryology in understanding anatomy, more weightage needs to be given to it, as noted in the present study.

As observed in the present study, student engagement and learning in embryology can be further improved by incorporating small group teaching (SGT). It has been found that SGT provides a friendly learning environment. It optimizes learning, especially compared to didactic lectures, particularly in healthcare. Students' knowledge is improved by actively building on their understanding and peer interactions. Additionally, SGT gives students a chance to collaborate and fosters teamwork abilities. To work in healthcare environments, you must possess specific skills (Burgess et al., 2020).

Shankar & Roopa, in their study, opined that traditional didactic lectures followed by modified team-based learning (TBL) sessions were better than conventional teaching methods (Shankar and Roopa, 2009). As observed in the present study, problem-based learning (PBL) can also be used in embryology.

Self-directed learning (SDL) can also be considered an alternate form of education (Pai et al., 2014). It has been found that retention of knowledge was better with SDL. It can further lead to collaborative learning and peer-to-peer interactions, enhancing embryology learning and retention.

Previously, it was discovered that 97% of students believed that peer teaching boosted their retention of the knowledge they had taught to their peers, and 100% of students agreed that peer teaching experience improved their grasp of the topics they had prepared (Krych et al., 2005). Similar practices can be utilized in embryology learning. This form of collaborative learning can be an effective educational strategy to promote peer collaboration in enhancing teamwork and communication skills (Glynn et al., 2006). It, in turn, would make the students more involved in learning embryology.

Al-Neklawy (2017), in their study on 100 Egyptian medical students, presumed that online anatomy teaching using learning management systems is an additional learning tool in the teaching-learning of anatomy. Herein the students can learn and understand concepts at their own pace. This kind of hybrid and flipped classroom approach may be applied in embryology learning and is beneficial. It has also been found that virtual reality tools further enhance embryology education when assessed both subjectively and objectively (Arendale, 2014).

All in all, the following measures can be taken to make embryology teaching-learning effective:

In the beginning, basic concepts of general embryology (i.e., topics such as gametogenesis, ovarian cycle, ovulation, fertilization, cleavage, implantation, placenta formation, etc.) should be taught leisurely and at a slow pace using models, 3D movies emphasizing clinical applications rather than describing the entire process.

Systemic embryology should be taught alongside gross anatomy sessions. During the sessions, less importance should be given to the entire formation process, and emphasis should be laid on the most common clinical applications.



Embryology can be made interesting to learn and easy to retain if it is taught with more clinical applications and a less detailed explanation of the entire process (as seen in current practice). Further, the TBL, PBL, and SDL sessions can be designed based on clinical applications, using the basic knowledge of embryology. These teaching-learning methodologies ensure that the students acquire the general and specific learning competencies in embryology. These methods are equally appropriate for both recent and experienced students.

## CONCLUSION

Embryology is an essential component of anatomy and medical education. Therefore, there is a need to reform the existing methodologies of teaching-learning embryology to enhance student engagement, as identified in the present study. Seeking students and faculty's perceptions about the current practices of embryology teaching and its impact on their learning becomes vital, as observed in the present study. Utilizing the feedback gained in improving the process of imparting embryology knowledge will result in a positive and active learning experience for the students. Further, the integration of the following practices, i.e., "Why teach embryology?" followed by "What and how should it be taught?", and then "When and where should it be taught?", will make embryology teaching-learning an enriching and rewarding experience for both students and faculty.

## RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

The impact of enhanced practices of embryology teaching-learning on students' performance can be assessed, analyzed, and further improvised. Its effectiveness can be evaluated by comparing it with the academic results. This measure can further instigate the policy makers or members of the respective board of studies to bring about further reforms in embryology's duration and teaching-learning practices.

## DISSEMINATION HISTORY

The current work was presented in part as a speech to the 68<sup>th</sup> National Conference of Anatom-

ical Society of India- NATCON-2022 organized by the Department of Anatomy, King George's Medical University, UP, Lucknow, from 28th -30th January 2022. The first author won the best paper award on this occasion.

## ETHICAL APPROVAL AND CONSENT

The KMC (Kasturba Medical College) and KH (Kasturba Hospital) Institutional ethics committees approved the conduct of the study. The study was performed following the ethics committee's relevant guidelines and regulations. The study participants were recruited after obtaining their written informed consent.

## ACKNOWLEDGEMENTS

Dr. Prasanna LC, Head of the Department of Anatomy, for his continued support and encouragement.

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