
A Research Study Titled:

# CADAVIZ

## MAKING SENSE OF THE JOURNEY FROM CELL TO SYSTEM

Presented at:

**THE 46TH ANNUAL CONFERENCE OF THE ASSOCIATION OF ANATOMISTS TAMIL NADU**

Presenting Author:

**Dr. G Durga Devi**

**Professor and HOD of Anatomy**

**Sree Balaji Medical College and Hospital**

**DEC**

**2025**

## ABSTRACT



### Background

Embryology is one of the most conceptually challenging areas in early medical education. Traditional resources, such as static textbook diagrams and non-interactive YouTube videos, often fall short in aiding learners to visualize subtle transformations and mentally reconstruct complex three-dimensional processes. To address these limitations, Cadaviz, a Virtual Dissection Table equipped with interactive 3D models, animations, and embedded videos, offers a pedagogically enriched digital alternative.

### Methods:

A cross-sectional, questionnaire-based study was conducted to assess student perceptions of learning embryology through Cadaviz. The instrument evaluated five key learning domains: conceptualization, visualization, spatial connection, knowledge retention, and clinical understanding. Responses were collected using a five-point Likert scale and analyzed descriptively to identify overall trends.

### Results

Students expressed consistently positive perceptions across all domains. In the conceptualization domain, Cadaviz was reported to enhance clarity of developmental sequences compared to conventional resources. Feedback under visualization highlighted the constraints of textbooks and non-interactive videos, with learners noting that Cadaviz's 3D models and animations made abstract embryological events more accessible. Improved spatial connection was attributed to the ability to rotate and explore structures from multiple angles, aiding the understanding of how early forms relate to adult anatomy. Regarding knowledge retention, students reported that repeated access and multimodal interactivity strengthened long-term recall. In the clinical understanding domain, participants felt better equipped to relate developmental processes to congenital anomalies without the limitations posed by traditional teaching methods.

### Conclusion

Cadaviz stands out as an innovative and pedagogically impactful tool that significantly enhances conceptual clarity, visualization, retention, and clinical integration in embryology education.

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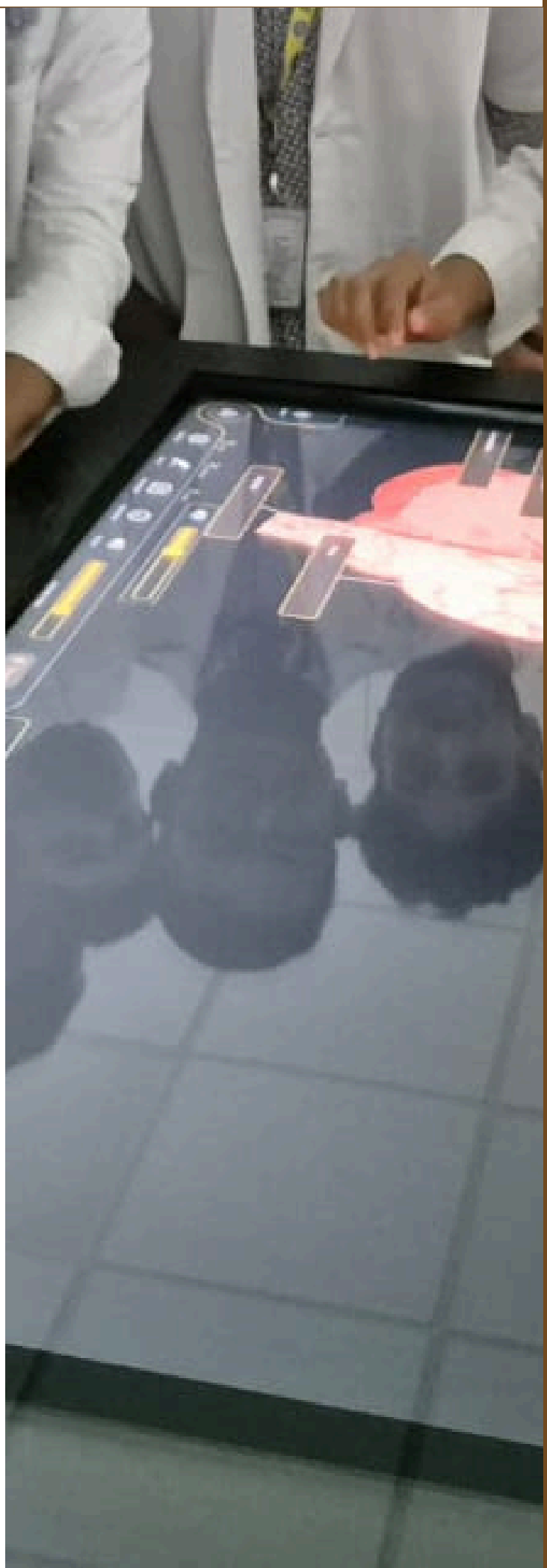


## PROBLEM STATEMENT

Students and educators face significant difficulty in understanding embryology due to the complex, dynamic, and three-dimensional nature of developmental processes. Traditional teaching methods—primarily static, two-dimensional images and diagrams—are often insufficient to convey the spatial and temporal changes that occur during human development, leading to gaps in comprehension and learning outcomes.[1]

## RESEARCH HYPOTHESIS

Cadaviz's interactive 3D embryology modules help in enhancing conceptual understanding by improving spatial visualization, temporal sequencing, and mental reconstruction.

## AIM OF THE STUDY

To explore students' perceptions of how digital tools like Cadaviz enhance learning in embryology.

## OBJECTIVES OF THE STUDY

- To assess students' perception of Cadaviz in improving conceptual understanding.
- To explore how students perceive Cadaviz in aiding visualization of development.
- To determine whether Cadaviz supports students' spatial understanding.
- To examine Cadaviz's perceived role in enhancing knowledge retention.
- To evaluate students' perception of Cadaviz in linking embryology with clinical practice.

## RESEARCH METHODOLOGY

### Study Design

A single-point, observational, cross-sectional feedback study.[2]

### Study Setting

Department of Anatomy, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.

### Sample Size

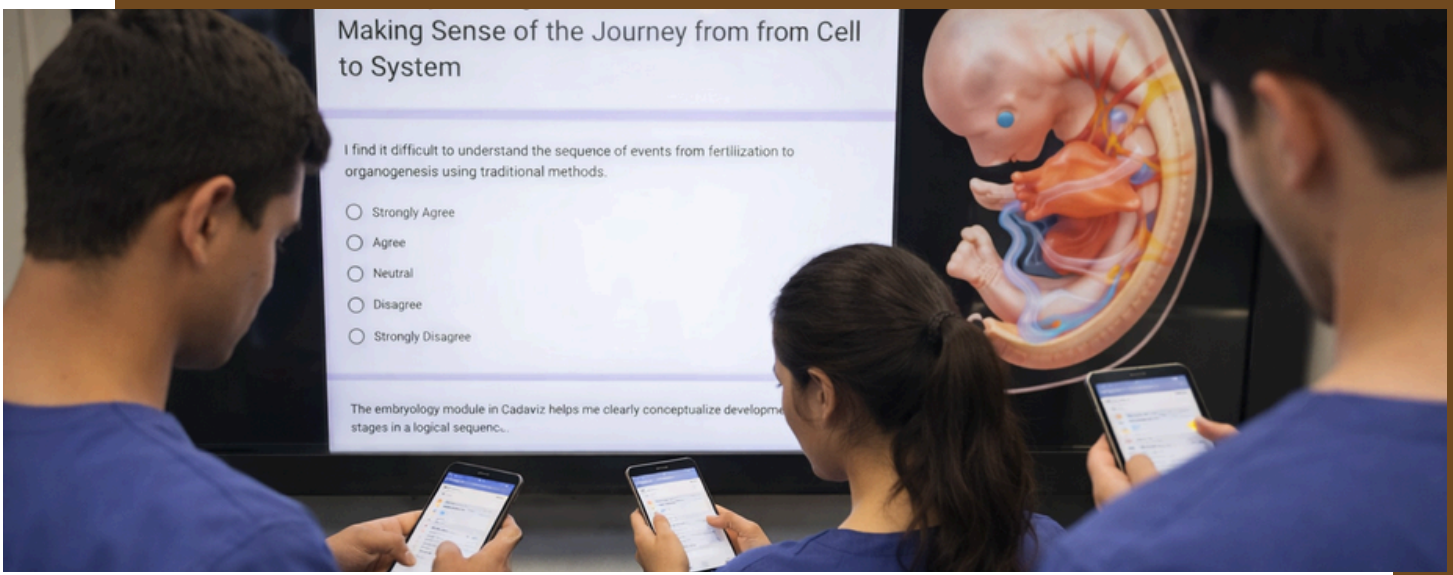
250 first-year MBBS students who provided informed consent and had previously learned embryology using Cadaviz.

### IEC and Informed Concent

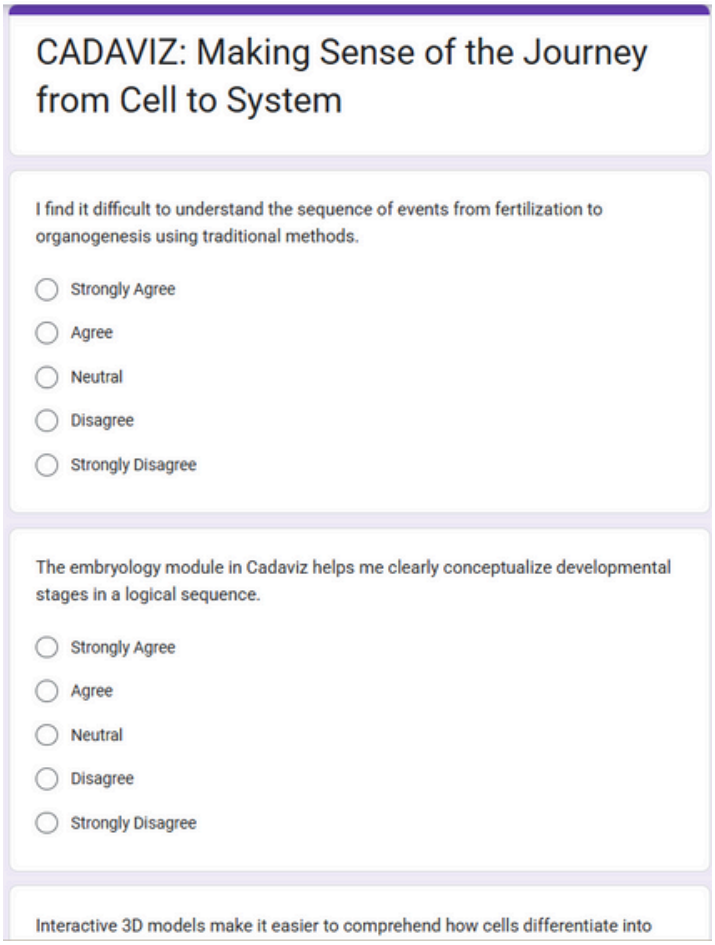
The study was conducted after obtaining IEC and informed consent from all participants.

### Data Collection and Analysis

The study employed a 5-point Likert scale ranging from “Strongly Agree” to “Strongly Disagree.”



## RESEARCH METHODOLOGY



CADAVIZ: Making Sense of the Journey from Cell to System

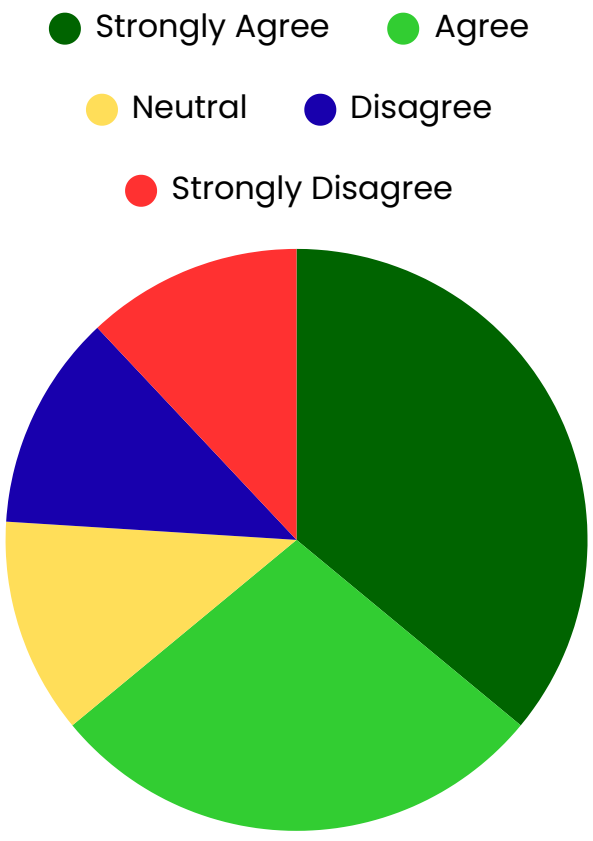
I find it difficult to understand the sequence of events from fertilization to organogenesis using traditional methods.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

The embryology module in Cadaviz helps me clearly conceptualize developmental stages in a logical sequence.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Interactive 3D models make it easier to comprehend how cells differentiate into




- Results reflect overall patterns in how students perceived the effectiveness of Cadaviz in learning embryology.

- Descriptive statistics were used to summarize perception trends across five key domains:

### → Conceptualization

Assesses how effectively learners form a clear understanding of embryological concepts and developmental processes.

### → Visualization

Evaluates the ability to visually interpret three-dimensional structures and dynamic changes during embryonic development.

### → Spatial relationship

Measures how well learners understand spatial relationships between developing anatomical structures over time.

### → Knowledge Retention

Examines the extent to which learners retain and recall embryology concepts after instruction.

### → Clinical Understanding

Assesses the ability to apply embryological knowledge to clinical contexts and developmental abnormalities.

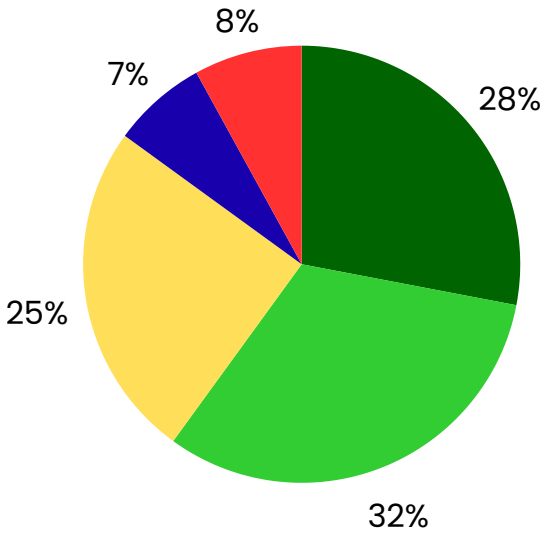
## RESULTS

Strongly Agree  Agree  Neutral  Disagree  Strongly Disagree

Results for the five domains are shown below using pie charts, with combined “Agree” and “Strongly Agree” responses reported as positive feedback.

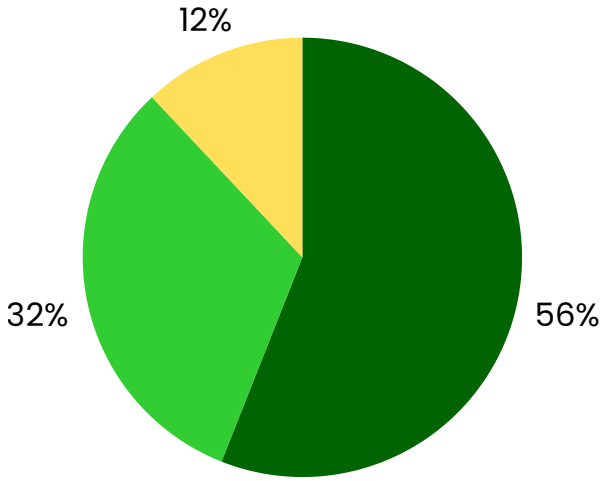
## Conceptualization

1. I find it difficult to understand the sequence of events from fertilization to organogenesis using traditional methods.



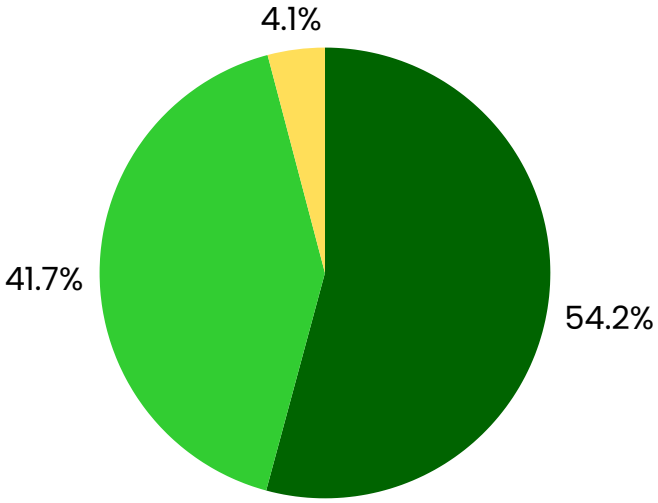

**60% of participants reported difficulty in understanding the sequence of embryological events using traditional methods.**

2. The embryology module in Cadaviz helps me clearly conceptualize developmental stages in a logical sequence.



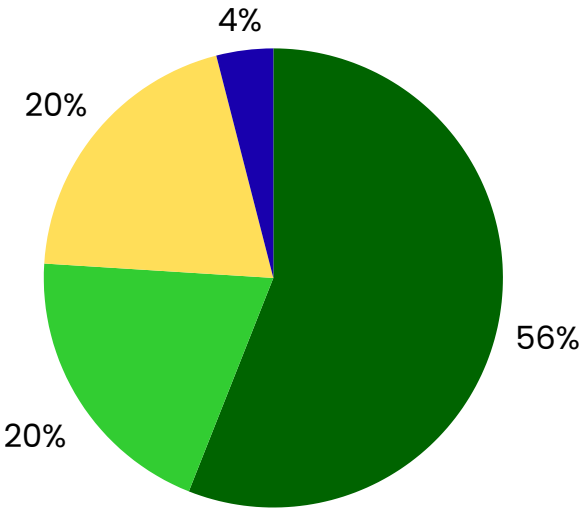

**88% of participants reported that CADAVIZ helps them conceptualize developmental stages in a logical sequence.**

3. Interactive 3D models make it easier to comprehend how cells differentiate into tissues and organs.




**95.9% of participants indicated that interactive 3D models make it easier to comprehend how cells differentiate into tissues and organs.**

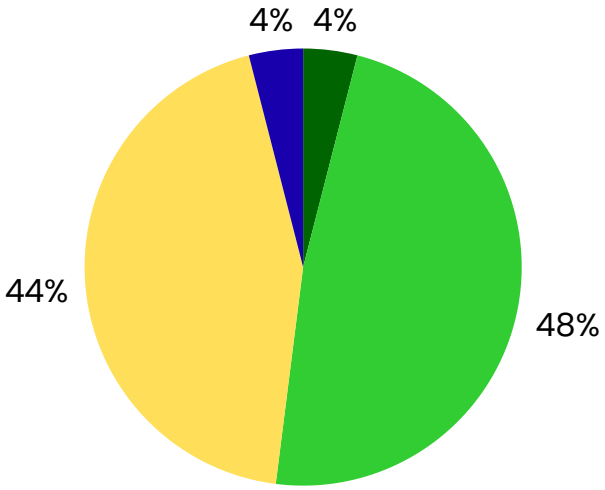
4. Cadaviz has improved my overall conceptual clarity in embryological development.




**86% of participants reported that CADAVIZ improved their overall conceptual clarity in embryological development.**

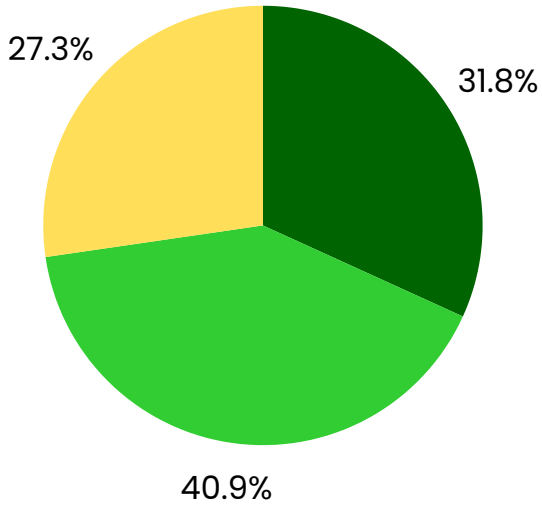
## Vizualization

5. Static textbook diagrams do not adequately represent the dynamic nature of embryonic development.



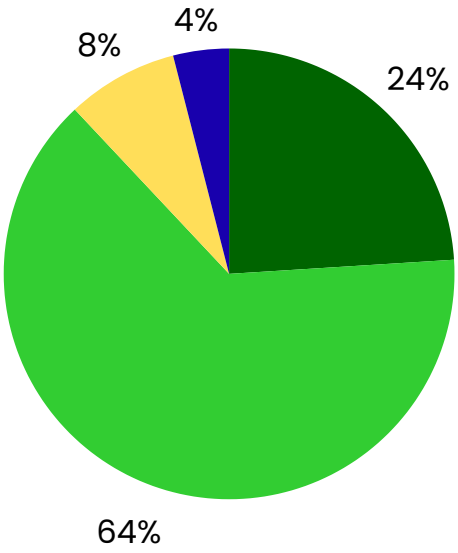

**52% of participants reported that static textbook diagrams do not adequately represent the dynamic nature of embryonic development.**

6. Animations in the module make complex processes like neurulation easier to understand.



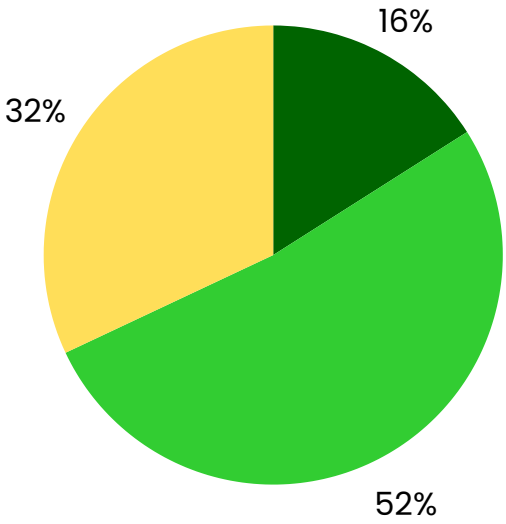

**72.7% of participants indicated that CADAVIZ animations in the General Embryology module make complex processes such as neurulation easier to understand.**

7. The 3D visualizations in Cadaviz help me better visualize the transformation from cell to system.




**88% of participants reported that interactive 3D models make it easier to comprehend how cells differentiate into tissues and organs.**

8. Compared to YouTube videos, Cadaviz provides a more interactive and engaging learning experience



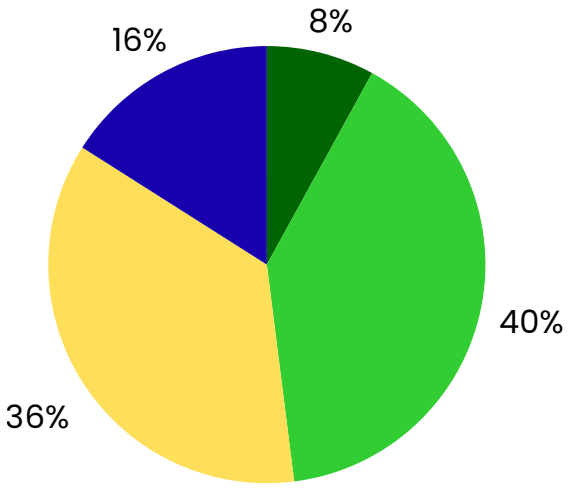

**68% of participants reported that, compared with YouTube videos, CADAVIZ offers a more interactive and engaging learning experience.**

## RESULTS

Strongly Agree  Agree  Neutral  Disagree  Strongly Disagree

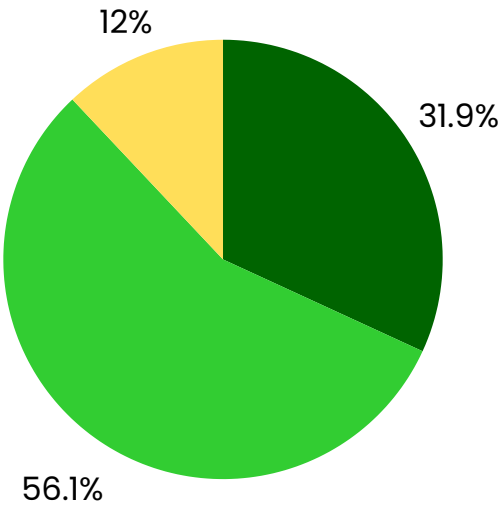
## Spatial Connection

9. I find it difficult to relate early embryonic structures to their adult anatomical counterparts.



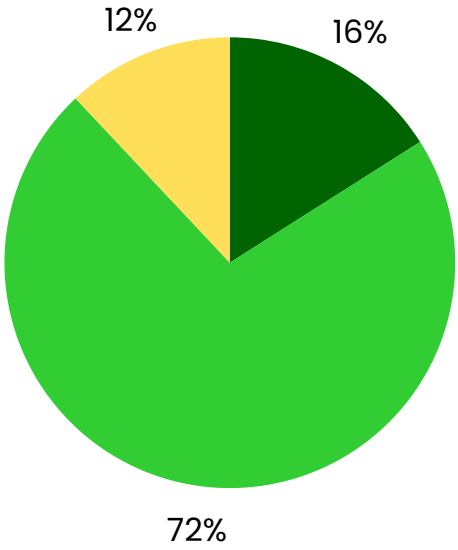

**48% of participants reported difficulty in relating early embryonic structures to their adult anatomical counterparts.**

10. The ability to rotate and explore 3D models in Cadaviz strengthens my spatial understanding of embryological structures.



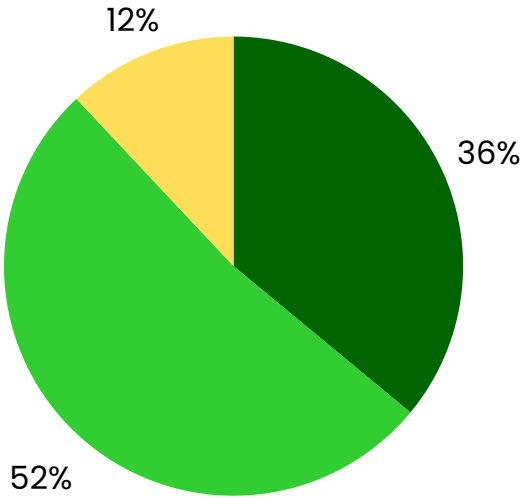

**88% of participants indicated that the ability to rotate and explore 3D models in CADAVIZ strengthens their spatial understanding of embryological structures.**

11. Cadaviz helps me connect developmental stages with the final position and orientation of organs in the body




**88% of participants reported that CADAVIZ helps them connect developmental stages with the final position and orientation of organs in the body.**

12. Viewing structures from multiple angles helps me comprehend spatial relationships among developing systems.

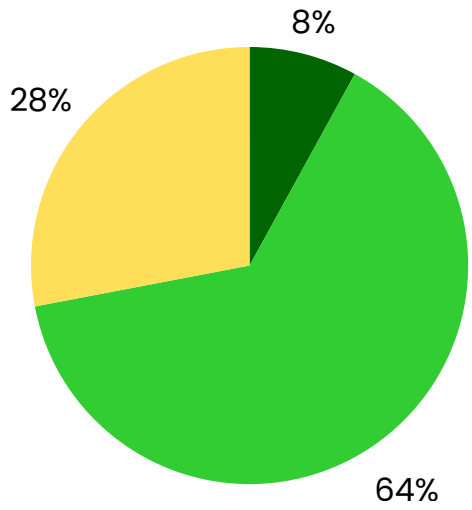



**88% of participants indicated that viewing structures from multiple angles in CADAVIZ improves their comprehension of spatial relationships among developing systems.**

Strongly Agree Agree Neutral Disagree Strongly Disagree

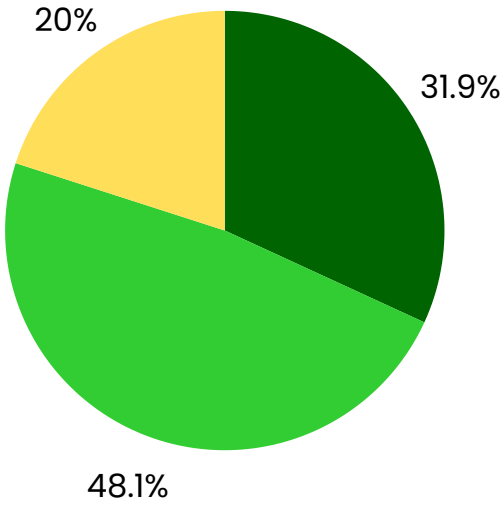
## Knowledge Retention

13. Studying from the General Embryology module of Cadaviz helped in increasing my retention of the abstract embryological concepts.



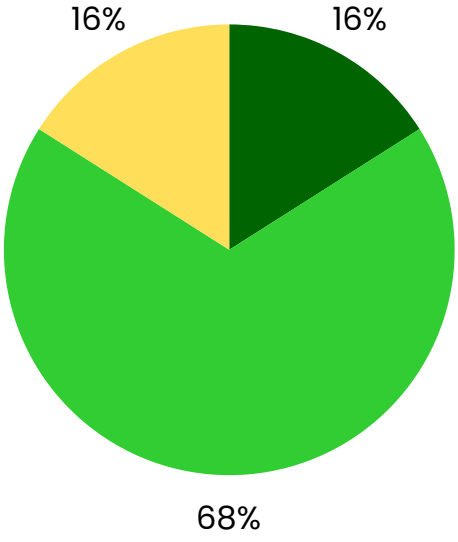

**72% of participants reported that studying the General Embryology module of CADAVIZ improved their retention of abstract embryological concepts.**

14. Revisiting modules again and again effectively reinforces my understanding of the subject.



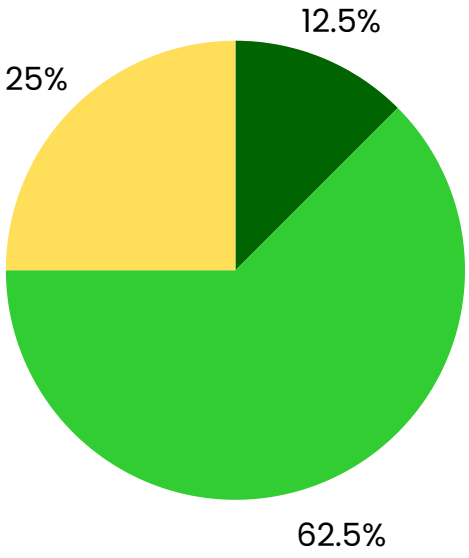

**88% of participants indicated that revisiting modules repeatedly reinforces their understanding of the subject.**

15. Learning through Cadaviz improves my recall of developmental stages during assessments.




**84% of participants reported that CADAVIZ helps them connect developmental stages with the final position and orientation of organs in the body.**

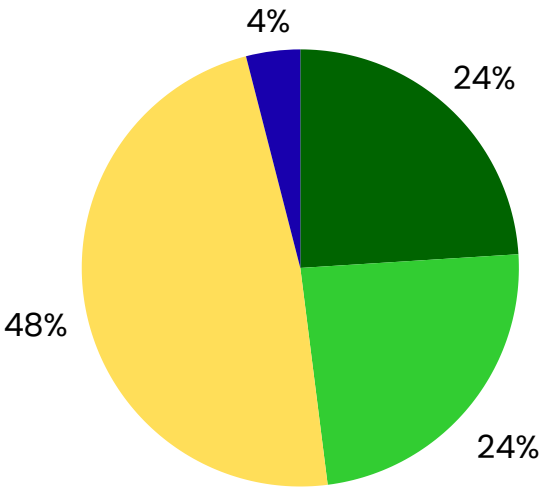
16. Compared to video-based learning, interactive modules like Cadaviz help me retain and recall information more effectively.




**75% of participants reported that, compared with video-based learning, interactive modules like CADAVIZ improve retention and recall.**

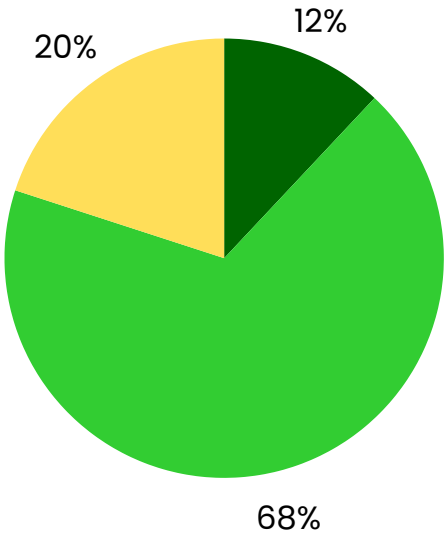
## Clinical Understanding

17. Traditional teaching methods make it hard to relate embryology to congenital anomalies.



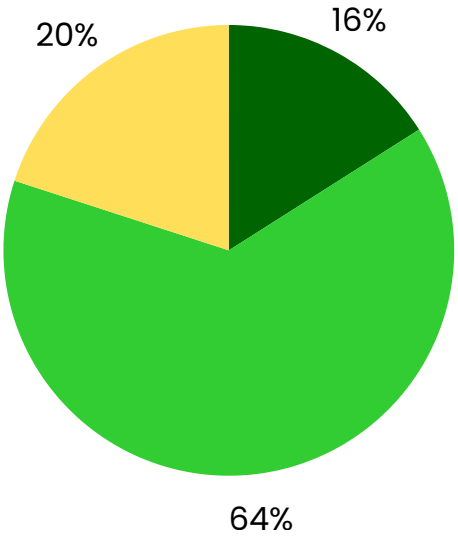

**48% of participants indicated that traditional teaching methods make it difficult to relate embryology to congenital anomalies.**

18. Cadaviz helps me correlate developmental processes with clinical conditions more effectively.



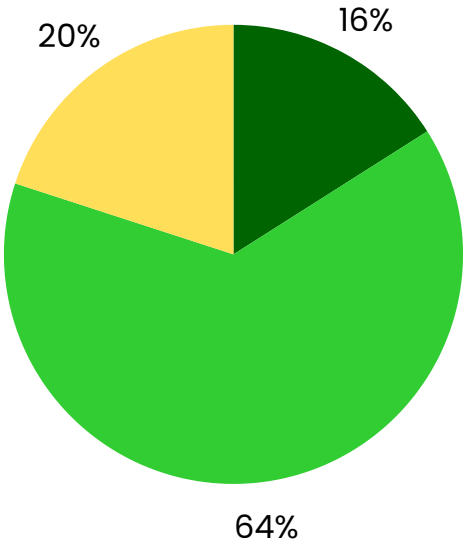

**80% of participants reported that CADAVIZ helps them correlate developmental processes with clinical conditions more effectively.**

19. Visualizing abnormal development through simulations improves my grasp of clinical embryology.




**80% of participants indicated that visualizing abnormal development through simulations improves their understanding of clinical embryology.**

20. Learning with CADAVIZ enhanced my ability to apply embryological knowledge in clinical contexts.




**80% of participants reported that learning with CADAVIZ enhanced their ability to apply embryological knowledge in clinical contexts.**

## RESULTS

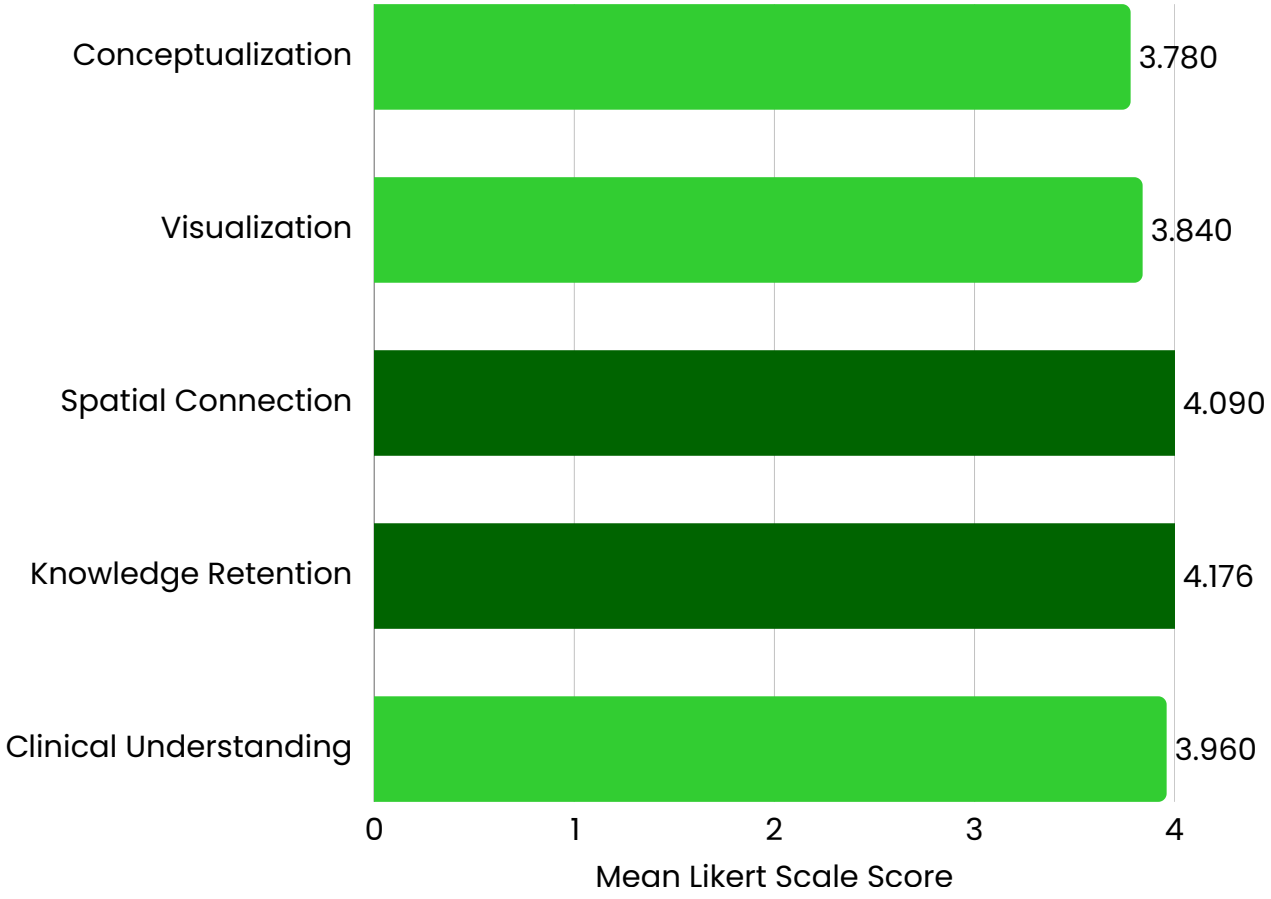



**Figure : Mean Likert-Scale Scores Across Learning Domains Using CADAVIZ**

- The x-axis represents the mean Likert-scale score, while the y-axis lists the five learning domains assessed.
- Conceptualization recorded a mean score of 3.78, indicating participants' responses toward understanding developmental sequences and abstract concepts.
- Visualization showed a mean score of 3.84, reflecting learner responses related to animated and visual representations of embryological processes.
- Spatial Connection achieved a mean score of 4.09, representing responses related to the ability to perceive spatial relationships among embryological structures.
- Knowledge Retention recorded the highest mean score (4.17) among the assessed domains.
- Clinical Understanding demonstrated a mean score of 3.96, reflecting learner responses related to the application of embryological knowledge to clinical contexts.

## DISCUSSION

The present study demonstrates that CADAVIZ effectively supports learners in making sense of the journey from cell to system, a core challenge in embryology and anatomical education. Across the five evaluated domains—conceptualization, visualization, spatial connection, knowledge retention, and clinical understanding—learner responses consistently reflect the ability of CADAVIZ to reimagine anatomy learning as a dynamic, integrated, and clinically relevant process.

## CONCEPTUALIZATION OF EMBRYOLOGICAL DEVELOPMENT

The mean score for conceptualization (Mean = 3.79) suggests a generally positive learner perception of their ability to understand embryological developmental sequences using CADAVIZ. This may be attributed to the structured presentation of developmental stages and the use of sequential visual representations, which support the progressive understanding of complex embryological concepts rather than treating them as isolated events. [3]

## VISUALIZATION OF DYNAMIC DEVELOPMENTAL PROCESSES

The mean score for visualization (Mean = 3.84) suggests that interactive visual representations enhance learners' understanding of embryological development. This may be because interactive visualizations depict dynamic morphological changes, making complex mental processes explicit, reducing cognitive load, and allowing learners to focus on structural relationships and developmental sequences more effectively than traditional static illustrations.[4]

## SPATIAL COGNITION IN EMBRYOLOGY LEARNING

The mean score for spatial cognition (Mean = 3.76) indicates that interactive visualizations support learners' ability to understand spatial relationships in embryological structures. This may be because such visualizations allow learners to manipulate and explore three-dimensional models, making complex anatomical arrangements more tangible and easier to mentally organize than traditional two-dimensional illustrations.[5]

## IMPACT ON KNOWLEDGE RETENTION

The mean score for knowledge retention (Mean = 3.71) suggests that interactive visualizations enhance learners' ability to retain embryological concepts.

## DISCUSSION

Repeated engagement with dynamic models reinforces understanding, making knowledge more durable. Learners who actively interact with visual content tend to retain information longer and apply it more effectively in new or clinical contexts. This aligns with established pedagogical principles, such as active learning, dual coding, and spaced repetition, which emphasize that knowledge is best retained through active, multisensory engagement rather than passive observation.[6]

## CLINICAL INTEGRATION OF EMBRYOLOGICAL KNOWLEDGE

The mean score for clinical integration (Mean = 3.78) indicates that CADAVIZ helps learners connect embryological concepts to clinical scenarios. this may be because CADAVIZ offers Interactive visualizations that enable students to observe developmental processes alongside pathological outcomes, making abstract concepts more concrete and facilitating a deeper understanding of the origins of congenital anomalies and developmental disorders.[7]

Such integration aligns with constructivist and situated learning principles, which emphasize that knowledge is retained and applied more effectively when learners can relate it to real-world contexts. By linking theory to practice, interactive models promote clinical reasoning and enhance the ability to apply embryological knowledge in diagnostic and therapeutic decision-making. [7]

## CONCLUSION

Understanding student perceptions is essential for evaluating any learning modality, especially in embryology with its inherent challenges. This study shows that CADAVIZ, through interactive visualizations, enhances comprehension from cellular processes to system-level organization. It improves visualization, spatial cognition, knowledge retention, and clinical integration. Active engagement makes complex developmental events more tangible and supports long-term learning. By following principles of active learning, dual coding, and constructivism, CADAVIZ strengthens both understanding and application of embryology, bridging the gap between foundational knowledge and clinical relevance.

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## CITE THIS CONTENT

Devi, G. D. (2025). Anatomy reimagined with CADAVIZ: Making sense of the journey from cell to system—A student perception study. Study presented at the 46th Annual Conference of the Association of Anatomists, Tamil Nadu, India. Sree Balaji Medical College and Hospital, pp. 1–13. https://immersivelabz.com/research-publications/