



National Board of Examination - Journal of Medical Sciences
Volume 2, Issue 4, Pages 307–322, April 2024
DOI 10.61770/NBEJMS.2024.v02.i04.004

ORIGINAL ARTICLE

Anatomy as a Basic Medical Science: Perceptions of Allied Health Science Students in an Indian Medical School

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Accepted: 06-February-2024 / Published Online 31-March-2024

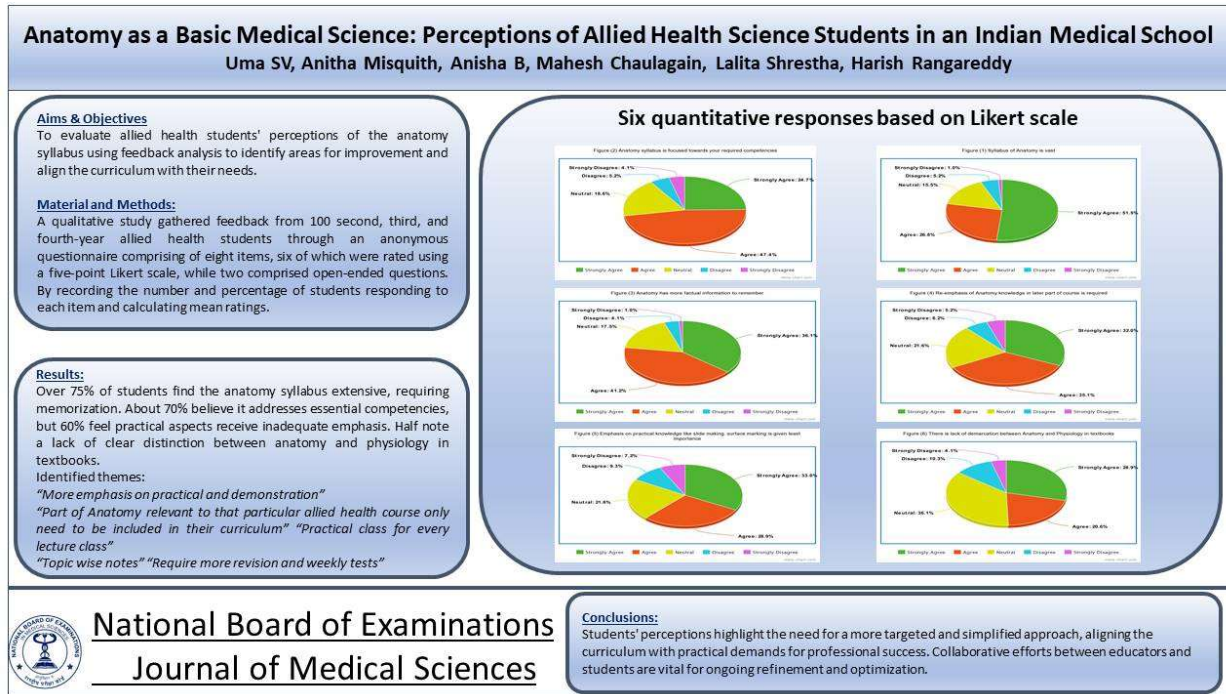
Abstract

Introduction: Anatomy courses in health science disciplines, including allied health programs, face criticism for being extensive and lacking focus on career-relevant competencies. **Objectives:** To evaluate allied health students' perceptions of the anatomy syllabus using feedback analysis to identify areas for improvement and align the curriculum with their needs. **Methods:** A qualitative study gathered feedback from 100 second, third, and fourth-year allied health students through an anonymous questionnaire comprising of eight items, six of which were rated using a five-point Likert scale, while two comprised open-ended questions. By recording the number and percentage of students responding to each item and calculating mean ratings. **Results:** Over 75% of students find the anatomy syllabus extensive, requiring memorization. About 70% believe it addresses essential competencies, but 60% feel practical aspects receive inadequate emphasis. Half note a lack of clear distinction between anatomy and physiology in textbooks. **Conclusion:** Tailoring the anatomy syllabus to specific allied health courses is crucial, focusing on appropriateness, conciseness, and well-defined learning outcomes. Students' perceptions highlight the need for a more targeted and simplified approach, aligning the curriculum with practical demands for professional success. Collaborative efforts between educators and students are vital for ongoing refinement and optimization.

Keywords: Anatomy, allied health occupations, educational needs assessment

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Graphical Abstract



Introduction

Anatomy holds a pivotal position as a foundational basic science course in the realm of health science disciplines [1]. Frequently perceived as a subject inundated with factual information and terminologies requiring rote memorization, its true value comes to light when applied in a clinical context, making clinical exposure a driving force for motivation [1, 2]. During the initial year of health science studies, the extent of students' engagement with the subject is often influenced by the evaluation process, while the realization of its true significance occurs when anatomy is integrated into the understanding and management of diseased conditions within the realm of healthcare practice [2]. The existing literature also highlights a common perception among allied health students that anatomy is learned solely for examination purposes, leading to

concerns regarding retention and application of the acquired knowledge in their respective fields. Furthermore, a lack of confidence is observed in applying anatomical knowledge to practical situations within their professional practice [3].

Allied health sciences (AHS) students express that human anatomy and physiology are perceived as challenging due to the use of scientific language and the incorporation of numerous new terminologies, leading to content overload [4]. Similarly, medical students also regard anatomy as a subject with an extensive syllabus, yet essential for its significant clinical applications. In a study by Gupta S et al, a more streamlined approach to the anatomy curriculum in MBBS, focusing on general concepts to impart a functional understanding of the subject is advocated [5]. This embeds the perception of

information overload among medical and AHS students leading them to view anatomy as an extensive and demanding discipline.

Noteworthy is the distinctive significance of anatomy among the basic sciences, as it presents unique advantages by providing visual cues for effective learning and facilitating the establishment of connections between theoretical knowledge and practical application, particularly in clinical practice, thereby proving advantageous for students [6]. However, the lack of integration between basic medical sciences and clinical practice during the educational process may pose a challenge to the relevance of these subjects. Consequently, achieving proficiency in basic medical science knowledge becomes imperative as it serves as a fundamental prerequisite for augmenting the understanding of clinical medicine and optimizing the overall learning experience [7].

Despite the significance of anatomy as a foundational course in allied health science programs, there exists a prevailing opinion among different stakeholders that the syllabus is excessively extensive and lacks the necessary focus on competencies essential for their careers. Additionally, practical anatomy sessions that form core competency are found to be insufficiently emphasized within the curriculum. A notable trend in basic medical science subjects reveals a relatively higher frequency of failures in anatomy compared to other disciplines.

In light of these concerns, our study aims to gain insight into the perceptions of allied health science (AHS) students

regarding various aspects of anatomy as a fundamental medical science. Through an assessment of students' feedback and perceptions, this research endeavors to improve the anatomy curriculum, enhancing the overall learning experience in medical education. Understanding students' perspectives on the anatomy learning process is vital for identifying areas that require improvement and exploring opportunities to make the instruction more effective and relevant. By gathering and carefully analyzing student feedback, we can identify the strengths and weaknesses of the current anatomy education approach and develop strategies to optimize the efficacy of anatomy instruction. Through these endeavors, we can bridge the gap between the curriculum and students' needs, ensuring a comprehensive and enriching educational experience in the realm of allied health science programs.

Methods

Study design: Cross Sectional descriptive study including both quantitative as well as qualitative components.

Setting: The study was carried out at Sapthagiri Institute of Medical Sciences & Research Center, a tertiary health care and a teaching hospital in urban South India under Rajiv Gandhi University of Health Sciences in 2019.

Participant and sampling: The allied health sciences students were informed in person about the study purpose with a description by the researchers. To increase the heterogeneity of the sample second, third year students and interns of AHS were sampled purposively. Sample size (n) for the

survey was calculated with the following equations: $x = Z (c/100)^2 r (100-r)$ and $n = N x / ((N-1) E^2 + x)$, where N is the population size, E is the margin of error (10%), r is the fraction of responses (50%), and $Z (c/100)$ is the critical value for the confidence level c (5%). The estimated student population of Sapthagiri Institute of Medical Sciences at the time of conduct of study was >1000. We initially assumed a margin of error of 10%. The margin of error (E) was calculated with the following equations: $x = Z (c/100)^2 r (100-r)$ and $E = \text{Sqrt} \left[\frac{(N-1)x}{n} \right]$, where N is the population size, r is the fraction of responses that we were interested in, and $Z (c/100)$ is the critical value for the confidence level c . Sample size obtained was 96 which was rounded off to 100. The AHS students from specific undergraduate programs falling under the umbrella of allied health students viz., cardiac care technology, perfusion technology, respiratory care technology, imaging technology, medical laboratory technology, anaesthesia technology, operation technology and renal dialysis were included. While the paper provides a general context of allied health science programs, specifying individual programs was avoided to maintain a broader focus on the overall perception of anatomy education among allied health students and moreover all these programs had the same curriculum.

Data collection tool: A structured questionnaire was used for data collection. The questionnaire (Table 1) has eight items, of that six using the Likert five-point grading scale with a maximum of 5 and a minimum of 1 with a range of score of 0.8 and two open ended questions. The items of

the questionnaire were adapted based on previous literature [5]. Pilot testing of the questionnaire was done on the first group of twenty students. The internal reliability of the questionnaire was found to be satisfactory (Cronbach's alpha of 0.70).

Prior to participating in the study, students were comprehensively briefed about the objectives, methodology, and the nature of the questionnaire. The importance of honest and thoughtful responses was emphasized. This ensured that participants had a clear understanding of the study's purpose and the significance of their contributions. The inclusion of informed participants adds validity to the gathered feedback.

After obtaining ethical clearance from the institutional ethics committee of Sapthagiri Institute of Medical Sciences and Research Center, the cross sectional descriptive study with convenient sampling methodology was conducted. A total of 100 students including the second year, third year students and the fourth year interns of allied health science courses have been included in the study as convenient sampling method during the mid of 2019. The First year AHS students who were studying anatomy as one of their first year subjects and the students who had not passed Anatomy exam till august 2019 were excluded from the study. The second year ($n=40$), third year ($n=35$) students and interns ($n=25$) were included as they have completed anatomy and are engaged in their clinical posting, so they are more aware about the anatomy syllabus which they learnt and its application in clinical side. Among the 100 students, girls were 54

(n=54) and boys were 46 (n=46) and their age ranges from 19 to 24 years.

Steps were taken to ensure that the researchers involved in the subject selection process remained impartial and did not introduce personal biases. This involved having a separate team responsible for participant questionnaire administration and data collection, which was not part of the study.

Data analysis: The number and percentage of students responding to each item noted. SPSS version 16 software was used for calculation of the mean rating for

each item and then tabulated. For the quantitative section, descriptive calculations of frequency and percentage were done, and for the open ended questions section, an inductive approach was used; themes were extracted by analyzing the content of participants' opinions.

Results

Among the hundred students invited to participate, ninety-seven successfully completed the questionnaire, as shown in Table 1.

Table 1. Questionnaire and responses of the participants

Sl. No.	Item Please respond to the following Course: Year:	Strongly agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)
1.	Syllabus in anatomy is too vast	50 (51.54)	26 (26.8)	15 (15.46)	5 (5.15)	1 (1.03)
2.	Is anatomy syllabus focused toward your required competencies?	24 (24.74)	46 (47.42)	18 (18.56)	5 (5.15)	4 (4.1)
3.	More of factual information in subject to remember	35 (36.08)	40 (41.23)	17 (17.52)	4 (4.1)	1 (1.03)
4.	Re- emphasis of anatomy knowledge in latter part of course is required	31 (31.96)	34 (35.05)	21 (21.65)	6 (6.18)	5 (5.15)
5.	Emphasis in practical knowledge like slide making, surface marking of blood vessels are given least importance	32 (32.99)	28 (28.87)	21 (21.65)	9 (9.27)	7 (7.21)
6.	There is lack of clear cut demarcation between anatomy and physiology in their textbooks	28 (28.87)	20 (20.61)	35 (36.08)	10 (10.30)	4 (4.1)
	Open ended questions 1. Mention two methods you prefer to learn anatomy 2. Give two reason for more failures in anatomy					

The findings of the six quantitative responses based on Likert scale are as follows

1. Syllabus in anatomy is too vast

This item has a majority in the Agree category (51.54% Strongly Agree, 26.8% Agree). It suggests that a significant portion of respondents feel the syllabus is indeed vast as shown in Figure 1.

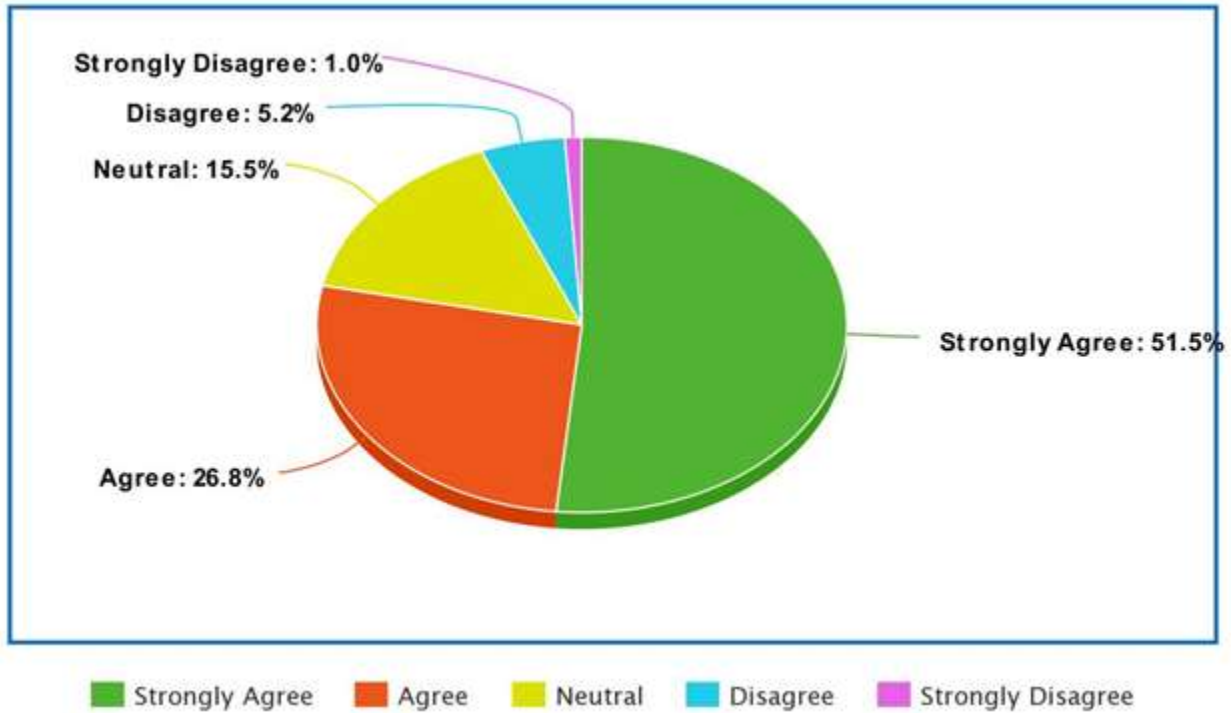


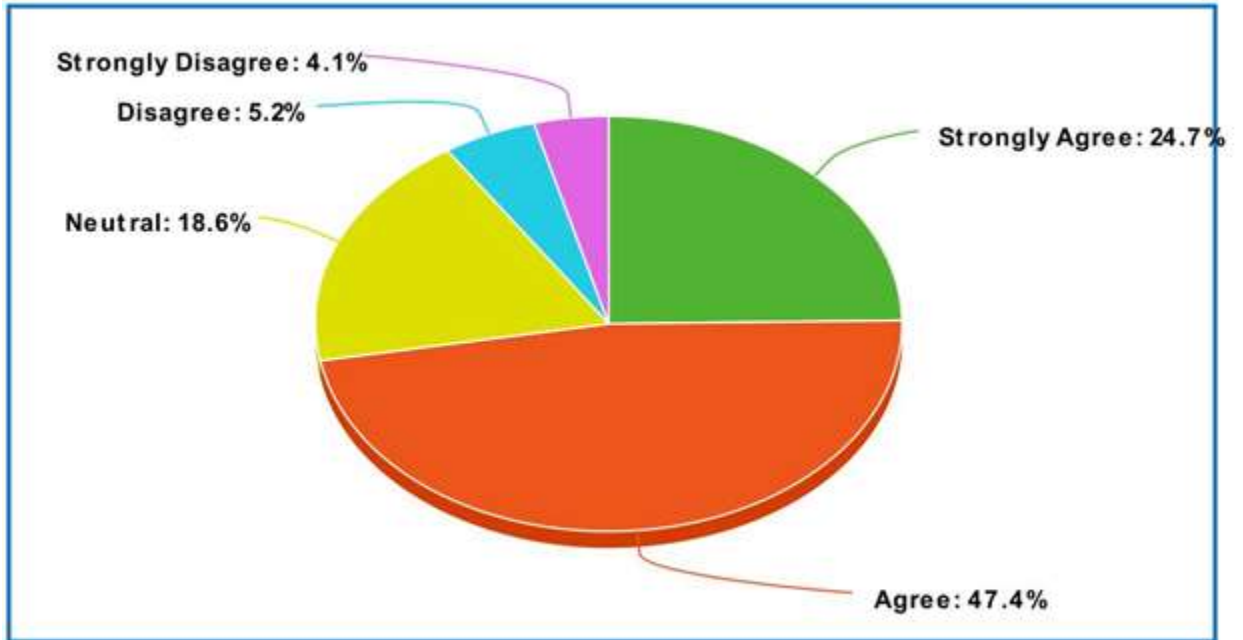
Figure 1. Syllabus of anatomy is vast

2. Is anatomy syllabus focused toward your required competencies?

A majority here as well in the Agree category (24.74% Strongly Agree, 47.42% Agree), indicating that respondents generally feel the syllabus is focused on required competencies depicted in Figure 2.

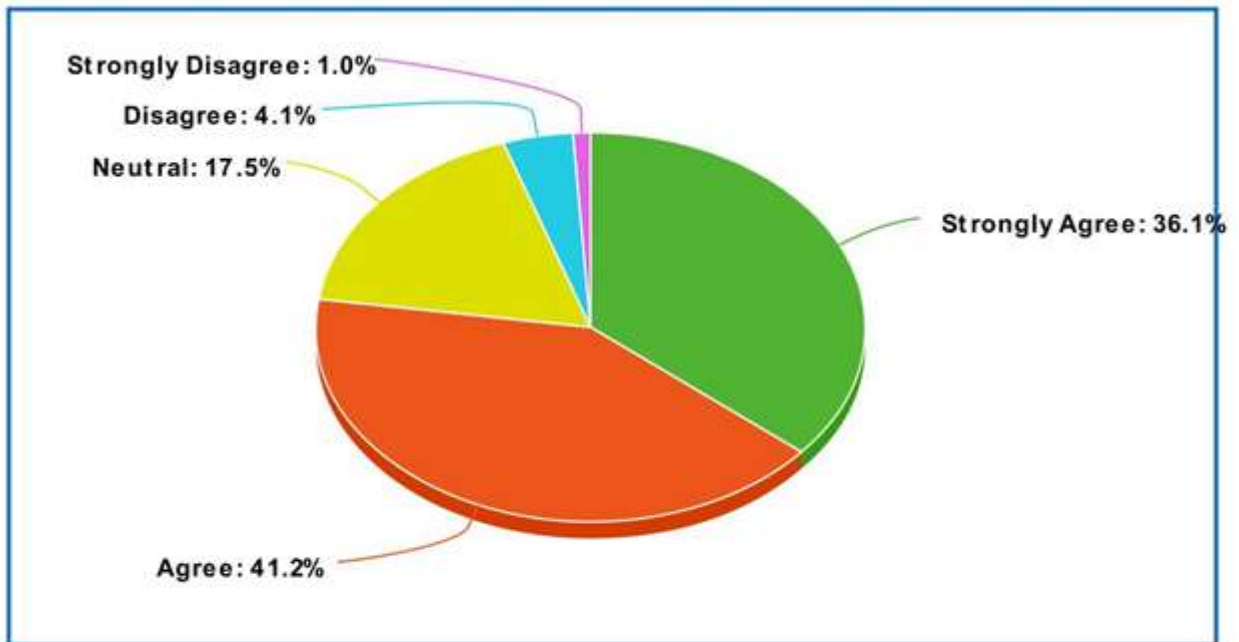
3. More of factual information in the subject to remember:

The majority falls in the Agree category (36.08% Strongly Agree, 41.23% Agree), suggesting agreement that the subject contains a significant amount of factual information revealed in Figure 3.



Strongly Agree Agree Neutral Disagree Strongly Disagree

Figure 2. Anatomy syllabus is focused towards your required competencies



Strongly Agree Agree Neutral Disagree Strongly Disagree

Figure 3. Anatomy has more factual information to remember

4. Re-emphasis of anatomy knowledge in the latter part of the course is required:

Responses are spread, but a substantial portion agrees (31.96%

Strongly Agree, 35.05% Agree) that re-emphasis in the latter part of the course is needed as shown in Figure 4.

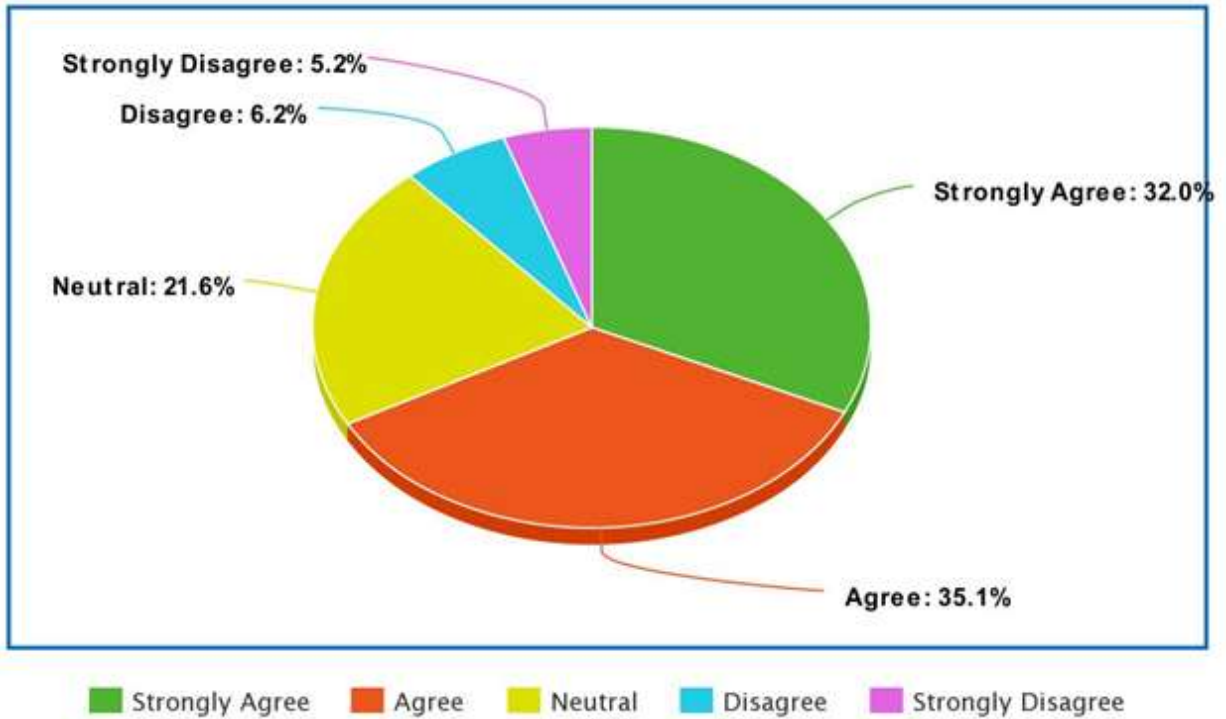


Figure 4. Re-emphasis of anatomy knowledge in later part of course is required.

5. Emphasis in practical knowledge like slide making, surface marking of blood vessels are given least importance:

There is a mixed response, but a considerable portion agrees

(32.99% Strongly Agree, 28.87% Agree) that practical knowledge is given less importance as depicted in Figure 5.

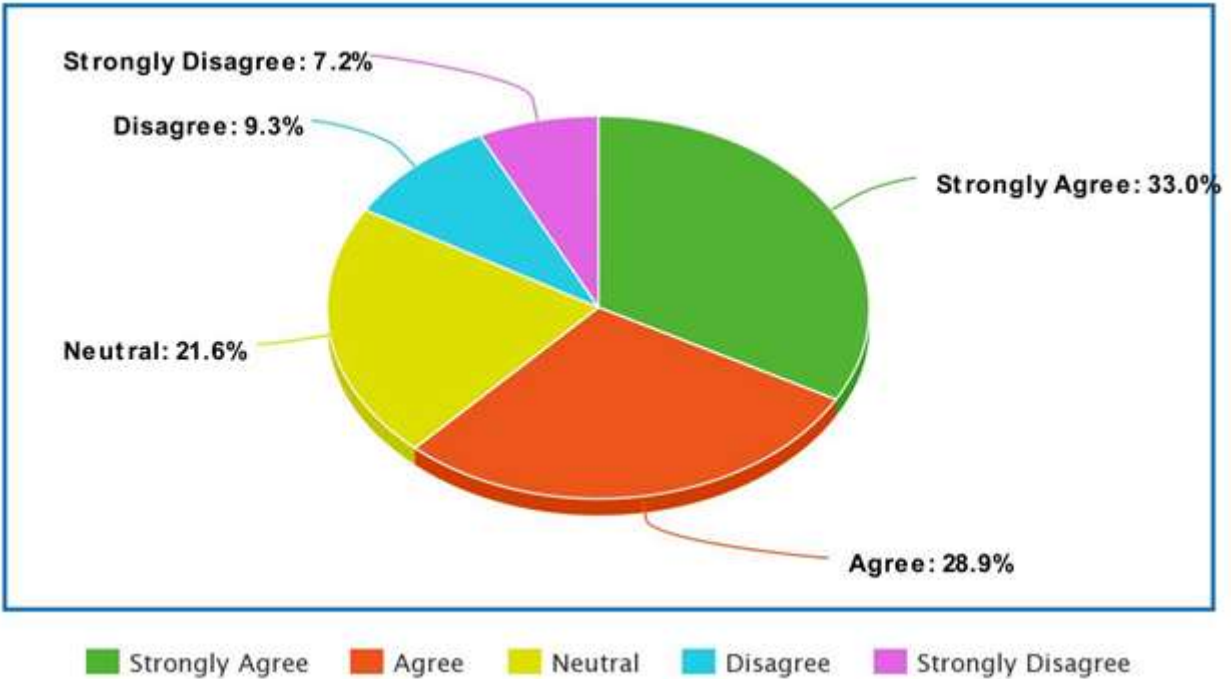


Figure 5. Emphasis on practical knowledge like slide making, surface making is given least importance.

6. There is a lack of clear-cut demarcation between anatomy and physiology in their textbooks:

A mixed response, with the highest percentage in the Neutral

category (36.08%). This suggests uncertainty or neutrality regarding the demarcation between anatomy and physiology in textbooks as revealed in Figure 6.

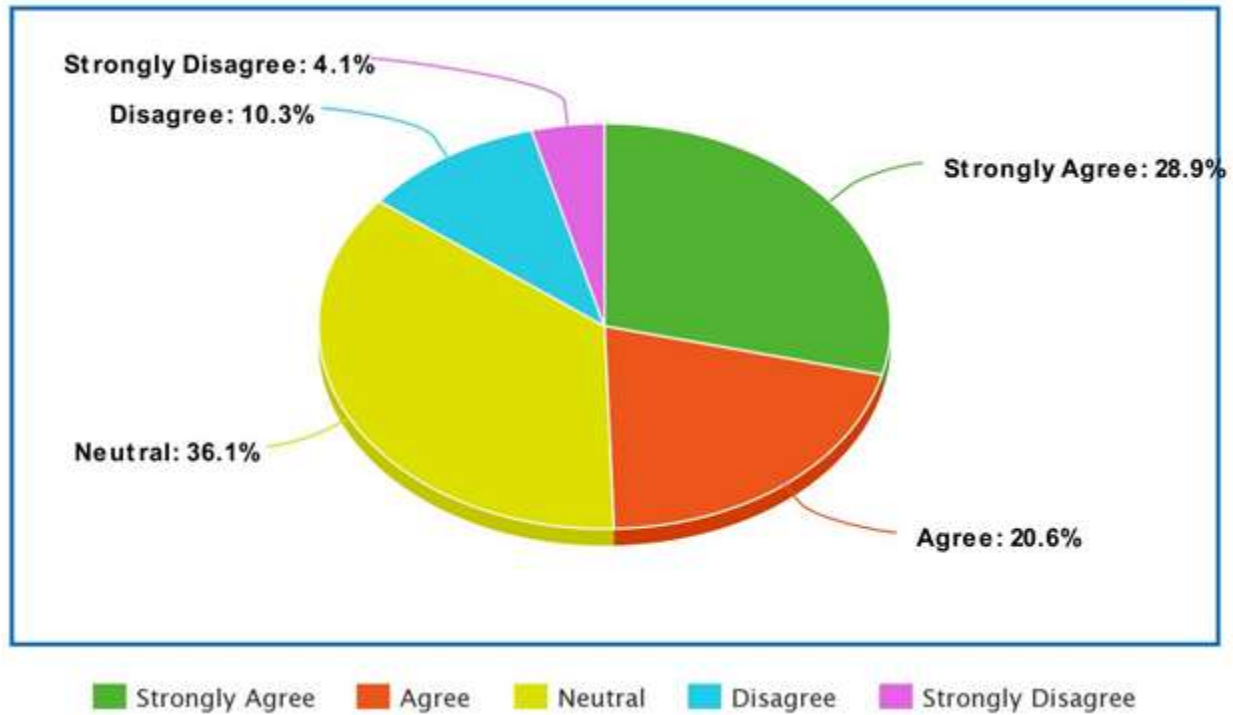


Figure 6. There is lack of demarcation between anatomy and physiology in textbooks

More than 75% of students felt that the Anatomy syllabus is vast and more factual information to remember. The summarized responses reveal that a significant majority, over 75% of students, perceive the Anatomy syllabus as extensive, demanding memorization of copious factual information. Around 70% of students acknowledge that the anatomy syllabus caters to their required competencies. However, 60% of students express concern about the limited emphasis on practical knowledge, such as slide making and surface marking of blood vessels.

For the open-ended questions of the methods they prefer for learning anatomy, the students responses include:

“More emphasis on practical and demonstration”

“Part of Anatomy relevant to that particular allied health course only need to

be included in their curriculum” *“Practical class for every lecture class”*

“Topic wise notes” *“Require more revision and weekly tests”*

According to the local university recommendation, the first year of all allied health courses like Respiratory care, Cardiac care, Medical lab technology, Renal dialysis, Operational technology all have a common syllabus as far as Anatomy is concerned. This makes the students feel their syllabus is vast. As the reasons for more failures in Anatomy, the students cited the following reasons:

“Syllabus of anatomy is too vast”

“Lots of new terminologies to understand”

“Textbook of anatomy is a common one and not according to their stream of courses”

“Less number of practical classes”

“Strict evaluation of the exam paper and increased requirement of 50 % pass percentage”

“Language problem and Students not comfortable asking doubts”

“More factual information in the subject so volatile and students find it difficult”

Furthermore, half of the students indicate a perceived lack of clear-cut demarcation between anatomy and physiology in their textbook. These findings provide valuable insights into the students' perspectives on the anatomy curriculum, highlighting both commendations and areas of potential improvement. Such feedback is instrumental in guiding curriculum refinement and enhancing the educational experience for the participating students.

Thematic analysis of the responses from the student questionnaire yielded four prominent themes that shed light on various aspects of their perceptions regarding the anatomy syllabus in allied health science programs.

1. *Perception of Vast and Factual Nature:* A significant number of students, over 75%, conveyed a common sentiment that the anatomy syllabus appears vast and overwhelming. They expressed apprehension about the extensive factual information that needs to be memorized, which may contribute to feelings of academic burden. This theme underscores the need to address the perception of content overload and explore strategies to streamline the

syllabus while ensuring essential concepts are retained.

2. *Alignment with Required Competencies:* Approximately 70% of students acknowledged that the anatomy syllabus is generally aligned with the competencies required for their future careers in allied health sciences. This positive perception indicates that the curriculum is designed to equip students with fundamental anatomical knowledge relevant to their professional roles. This theme highlights the importance of maintaining the alignment between curriculum content and the practical skills needed in the healthcare field.
3. *Inadequate Emphasis on Practical Knowledge:* A notable proportion, 60% of students, expressed concern about the limited emphasis on practical aspects of anatomy education, such as slide making and surface marking of blood vessels. Students considered these practical skills crucial for their clinical practice and emphasized the need for more hands-on experiences. This theme underscores the significance of incorporating practical sessions into the curriculum to enhance students' application-oriented learning.
4. *Ambiguity in Anatomy and Physiology Demarcation:* Half of the students perceived a lack of clear-cut demarcation between anatomy and physiology within their textbook. This finding suggests that the boundaries between these two essential subjects are not clearly delineated, which may lead to confusion in understanding their distinct concepts. This theme highlights the importance of clarifying and organizing

the curriculum to facilitate better comprehension and integration of these foundational sciences.

Collectively, these identified themes provide valuable insights into the students' perspectives on the anatomy syllabus. Addressing these themes in curriculum planning and implementation can lead to more focused and effective anatomy education, promoting a positive and enriching learning experience for allied health science students.

Discussion

The results of the present study are in line with the findings reported by other researchers globally, indicating that the perceptions and challenges surrounding anatomy education are prevalent across various medical and allied health science disciplines. In Gupta et al.'s study involving 200 MBBS students of different professional years, the issue of curriculum overload, particularly in anatomy, was identified as a significant problem faced by students [5]. This aligns with the current study's theme of "Perception of Vast and Factual Nature," where more than 75% of allied health science students felt that their anatomy syllabus is extensive and laden with factual information. The perception of content overload, leading to overburdened study and limited time for other subjects, resonates with both studies.

Similarly, Bergman's study on undergraduate perceptions of anatomy across 76 students revealed that clinical exposure acted as a prime motivating factor for studying anatomy [2]. This corresponds

with the current study's theme of "Alignment with Required Competencies," where around 70% of students acknowledged that the anatomy syllabus aligned with their essential competencies. The significance of clinical application and its role in motivating students to learn anatomy was evident in both studies.

Additionally, the findings from a study conducted in the United Kingdom (UK), focused on learning anatomy in the context of speech and language science students, are consistent with the current study's theme of "Inadequate Emphasis on Practical Knowledge" [3]. The UK study reported that students struggled with learning anatomy, found the amount of material daunting, experienced difficulty in memory retention, and lacked confidence in their knowledge base. These challenges are mirrored in the current study, where 60% of allied health science students expressed concern about the inadequate emphasis on practical knowledge like slide making and surface marking of blood vessels.

In the context of Australian University, a study focused on Biomedical Science (BMS) students revealed valuable insights into their perceptions of teaching methods employed in a first-year introductory anatomy and physiology unit. The BMS students recommended greater utilization of blackboard teaching, increased use of cadavers, and a higher number of dissections. Moreover, the students emphasized that their interest and engagement in a particular unit were driven by its relevance to their degree program [8]. This observation underscores the importance of tailoring anatomy education to the

specific needs of each branch within Allied Health Sciences (AHS). By providing detailed and focused anatomy content relevant to their future practice, students are more likely to become deeply interested and enthusiastic learners. For instance, a renal dialysis student would be more engaged in learning detailed renal anatomy, which is directly applicable to their practice.

Across different geographical and cultural backgrounds, a study in Ethiopia found that medical students displayed a positive attitude toward basic medical science subjects, particularly anatomy and physiology, as they perceived them to be highly relevant to their clinical practice [9]. A similar view was shared by medical students at all stages of their course, regardless of whether they were in their first year or final year [10]. These findings reinforce the significant role of anatomy in medical education and clinical studies.

Experts recommend that enhancing anatomy education can be achieved through the integration of relevant clinical applied anatomy and adopting active learning techniques [11, 12]. Vertically integrating anatomy education has also been suggested as a valuable approach, allowing students to participate more directly in their learning and yielding more favorable results compared to traditional passive methods [13].

In the United Kingdom, life science nurse educators collaborated with the Anatomical Society to develop a detailed discipline-specific core anatomy syllabus, systematically organized system-wise with defined learning outcomes. This syllabus enables nurse educators to emphasize the

relevance of anatomy to nursing practice, enhancing students' understanding and application of anatomy principles [14]. Similarly, involving allied health science practitioners and anatomy teachers in planning the syllabus for each allied course, incorporating defined learning outcomes, can create a curriculum that resonates with students and highlights the practical relevance of anatomy in their clinical practice.

The findings from various studies align with the current research, emphasizing the significance of tailoring anatomy education to meet the needs of specific disciplines within AHS. By incorporating relevant clinical applied anatomy, adopting active learning techniques, and creating well-structured syllabi with defined learning outcomes, educators can promote student engagement and interest in anatomy, leading to a more enriched and applicable learning experience. The similarity between the results of the present study and the findings from other researchers globally indicates a shared set of concerns and perceptions regarding anatomy education. These consistencies highlight the need for concerted efforts to address curriculum design, emphasize practical aspects, and ensure alignment with students' future professional needs.

In the context of improving teaching and learning in Anatomy, the integration of virtual learning methods can be a valuable approach. Virtual learning technologies offer innovative and interactive tools that can enhance students' understanding and engagement with anatomical concepts. Virtual anatomy platforms provide realistic

3D models and interactive simulations, allowing students to explore anatomical structures in a dynamic and immersive manner. Through these virtual environments, students can manipulate anatomical structures, visualize complex relationships, and gain a deeper understanding of spatial anatomy, which may be challenging to achieve through traditional teaching methods alone [15, 16].

Moreover, virtual learning platforms enable self-paced learning, allowing students to revisit challenging concepts and review materials as needed. This flexibility accommodates different learning styles and ensures that students can grasp fundamental anatomical knowledge at their own pace. Incorporating virtual anatomy dissection experiences can also be beneficial, particularly in cases where access to cadavers or physical dissection labs is limited. Virtual dissection tools provide a safe and ethical alternative for students to explore anatomical structures and practice dissection techniques (15, 16).

Additionally, virtual learning platforms can facilitate collaborative learning experiences. Students can engage in virtual group discussions, share insights, and work together on complex anatomical cases, promoting active learning and knowledge exchange. However, while virtual learning offers numerous advantages, it is essential to recognize its potential limitations. Some students may require additional support and guidance to navigate virtual platforms effectively, and educators should ensure that adequate training and resources are provided to facilitate seamless integration.

Limitations and suggestions

Limitations of this study include the potential for data saturation in the qualitative analysis. Although efforts were made to gather a diverse set of responses from 100 students, the sample size may not have been sufficient to reach data saturation. As a result, certain perspectives or insights from students might not have been fully captured, limiting the comprehensiveness of the study findings. Response bias is another noteworthy limitation. While the questionnaire was designed to maintain anonymity and encourage honest responses, students may have been inclined to provide socially desirable answers or refrain from expressing their true opinions due to various reasons such as fear of judgment or desire to conform to perceived norms. This bias could have influenced the reported perceptions, potentially leading to an underrepresentation or overrepresentation of certain viewpoints. Despite these limitations, the study provides valuable insights into the perceptions of allied health science students regarding their anatomy syllabus. To mitigate the limitations, future studies could employ larger sample sizes and diverse data collection methods, such as focus group discussions or interviews, to ensure data saturation and minimize response bias, thereby yielding more comprehensive and robust findings. The analysis did not specifically consider gender differences in perceptions. The primary focus was on understanding overall trends and commonalities in the perceptions of allied health students regarding the anatomy curriculum. While gender-specific analysis

could provide additional insights, it was beyond the scope of this particular study.

Conclusion

In conclusion, a significant majority of students, approximately three-fourths, perceive the anatomy syllabus to be extensive and overwhelming. Additionally, 60% of students express concerns about the insufficient emphasis on practical knowledge, such as slide making and surface marking of blood vessels, while half of the students identify a lack of clear-cut distinction between Anatomy and Physiology in their textbooks. To address these findings, it is crucial to tailor the anatomy syllabus for each allied health science course, incorporating defined learning outcomes that align with the specific needs of students in their future clinical practice. Moreover, the integration of practical skills relevant to their professional roles is essential to enhance the students' engagement and interest in anatomy education. By adapting the curriculum to meet the unique requirements of each allied health discipline and incorporating practical applications, educators can foster a more meaningful and enriching learning experience for the students. This approach will better prepare them for their respective healthcare roles and nurture a deeper appreciation for the importance of anatomy in their clinical practice.

Acknowledgments

This article was the result of a cross sectional study approved by Sapthagiri Institute of Medical Sciences and Research Center. The authors would like to express

their appreciation and gratitude to the Department faculty and students who participated in this study.

Authors' contributions

SVU, AM, AB, MC, LS, HR-All the authors participated in the process of the initial writing of the manuscript, its revision, presentation of the idea and initial design, and collection and analysis of data. Moreover, all authors accept the responsibility for the accuracy and correctness of the contents of the present manuscript and approve the final version of the manuscript.

Conflict of interests

The authors report no actual or potential conflict of interest.

Ethical considerations

This study was conducted based on the principles of the Declaration of Helsinki. Before the study, the approval of the Institutional Ethics Committee of Sapthagiri Institute of Medical Sciences and Research Center (No. IEC NO SIMS&RC/IECC06/2012) was obtained.

Funding

There was no funding for the study

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