

Original Article

## Bolstering medical education: Development and validation of a questionnaire for comparative study of heutagogical and andragogical teaching approaches in 1<sup>st</sup>-year medical students

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### ABSTRACT

**Objectives:** Medical education is evolving with the integration of newer approaches alongside traditional pedagogical methods based on didactic lectures. New learner-centred strategies foster a dynamic learning environment and enhance critical thinking amongst students. This study explores the impact of heutagogical teaching strategies compared to andragogical teaching-learning (TL) methods, specifically assessing their effectiveness in improving achievement motivation and academic confidence amongst 1<sup>st</sup>-year MBBS students.

**Materials and Methods:** The study employed a two-phase design: First, developing and validating a teaching learning questionnaire (TLQ) to assess and compare students' perceptions of andragogical and heutagogical teaching methods, and second, assessing learning outcomes using TLQ. About 99 1<sup>st</sup>-year MBBS students completed the TL questionnaire using a Likert scale. Teaching sessions were conducted on 'Exercise Physiology' using an andragogical approach and 'Autonomic Nervous System' using a heutagogical approach. Post-test assessments and student feedback from each session were analysed to determine the effectiveness of both methods.

**Results:** In the first phase of the study, a 13-item TL questionnaire was developed after validation following standard procedures. It showed strong content validity (content validity index = 0.97 and content validity ratio = 0.88) and reliability (Cronbach's alpha = 0.97 and intra-class correlation coefficient = 0.96). Factor analysis indicated two factors in the TLQ, accounting for 71.79% of the variance, with most items showing strong factor loadings. In the second phase, 1<sup>st</sup>-year MBBS students expressed a preference for heutagogical teaching, with 76% favouring it over traditional methods and 98% reporting higher satisfaction with this approach. Students reported increased motivation, problem-solving skills, creativity, and confidence with the heutagogical style.

**Conclusion:** This study highlights the significance of both heutagogical and andragogical TL methods in medical education to foster a dynamic and effective learning environment. The validated TLQ provides a reliable tool for evaluating teaching strategies across medical disciplines. This study also underscores the potential of heutagogical learning in developing achievement motivation and confidence amongst medical students. Further research with larger sample sizes is recommended to confirm these findings and assess the broader applicability of both TL strategies.

**Key words:** Academic confidence, Achievement motivation, Andragogy, feedback, Heutagogy, Teaching learning

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## INTRODUCTION

The medical education system is currently undergoing a metamorphosis and shifting away from traditional pedagogical teaching modes, and is now focusing on adult learning principles by embracing novel teaching methods. In line with global trends, medical educationists in India have emphasised restructuring medical curricula to produce healthcare professionals capable of addressing regional healthcare challenges. A competency-based undergraduate curriculum was introduced and implemented in August 2019 in India.<sup>[1]</sup> Implementing new education practices imparts benefits by fostering the development of skills and positive attitudes in medical students and sculpting the next generation of teachers.<sup>[2]</sup>

Further progression from pedagogy to andragogy to heutagogy represents a continuum focusing on stakeholders' learning as they mature in their thought processes.<sup>[3]</sup> The pedagogical teaching method, a teacher-controlled practice, is built on the premise that students lack experiential learning. In the andragogical way of teaching, students participate in the learning process, which the teachers supervise and guide. Such approaches include problem-based learning, self-directed learning (SDL), and case-based learning. In such practice, the teacher defines the course content and the learning objectives, and students prepare to learn the content.<sup>[4]</sup> Heutagogy comprises self-determined learning, which is a relatively new and underutilised approach. Thus, heutagogy, or the peer-led student-driven teaching method, may be an alternative or extension to traditional didactic teaching methods.<sup>[5]</sup> Incorporating heutagogical principles may be effective and productive learning in the rapidly growing digital era, where access to information is unbound. Most students and faculty members have access to digital media and adequate infrastructure to use them for academic purposes.<sup>[6,7]</sup> In the heutagogical approach, the learner is the fulcrum of learning, and the teachers subscribe to varying roles ranging from facilitators, coaches, motivators, good listeners, and persuaders to communicators.<sup>[8]</sup> The learner sets the tone and content of the learning course and is fully involved in designing and developing the map of learning.<sup>[9]</sup> Thus, the transition from andragogy to heutagogy expands the andragogic approach from self-directed learning to authentic self-determined learning (SDL), where the student exercises autonomy to determine and direct their learning path and process.<sup>[10]</sup>

Both andragogical and heutagogical principles have been utilised to varying degrees in good education practices. Andragogy identifies and concentrates on the best learning methods in a structured education environment, but does not evaluate the learning process. On the other hand, heutagogy includes educational initiatives for gaining knowledge of learning and the topic in both formal and informal settings.<sup>[6]</sup>

To evolve into heutagogical learners, students must embrace openness to exchange ideas with others, acknowledge gaps in their understanding, and seek ways to grow further.<sup>[11]</sup> Although independent, the learner in a heutagogical context has access to guidance and mentorship when required. The heutagogical approach requires and ensures that the learner is a problem-finder, curious, and adapts to navigate complexity and uncertainty effectively.<sup>[11]</sup> Heutagogy, with its holistic approach to capability development through proactive strategies, is the right approach for learning in an ever-changing, dynamic field of medicine. The progression from principles of pedagogy and andragogy to heutagogy in teaching–learning (TL) practices is based on the increasing complexity of the learning process with changing times and the rapid evolution of technology.<sup>[12]</sup>

While heutagogy is gaining momentum gradually in medical education, its effectiveness over traditional teaching methods remains under-researched. Therefore, a more in-depth investigation is required to understand the effectiveness and medical students' perspectives of the new approach based on heutagogical principles vis-à-vis traditional didactic teaching methods. This study evaluates students' views of heutagogical principles about other teaching methods and their impact on motivation, confidence, and academic performance. The present study provides a reflective look using a case study approach, which may provide a scaffold for a self-determined learning approach and show how this approach can be integrated with other disciplines.

The objectives of this study are first to develop and validate a questionnaire to evaluate the impact of heutagogical methods of TL compared to ongoing teaching methods and second to study the students' perception for heutagogical teaching method in physiology at the undergraduate level using the same questionnaire and to assess their academic performance based on different TL methods.

## MATERIALS AND METHODS

The study was conducted in two phases:

### First phase of the study

A Likert-scale TL questionnaire to assess the impact of the heutagogical approach in 1<sup>st</sup> year medical students was designed and developed after subjecting it to validity and reliability procedures.

### Participants in the study

Ten faculty members participated as experts for content validation during the first phase of the study. 99 1<sup>st</sup> year MBBS students volunteered for this study. The inclusion criteria require the student participants to be 1<sup>st</sup>-year medical students

who gave consent to be a part of the research. This group of students was a homogeneous group of participants who had already completed 10 months of physiology training (both theory and practical). Their responses were integral during the first phase of the study only. The students were informed of the research and its aims. Confidentiality and anonymity were assured, and their right to leave the project was explained, and consent for the use of the data was obtained.

### **Developing a questionnaire**

#### *Dimensions of the TL questionnaire*

Literature review suggests that learning is a multidimensional construct, and there has not been agreement on the dimensions of learning. A Likert-scale TL questionnaire was designed to explore the construct of andragogical and heutagogical way of teaching, which focused on two probable dimensions identified in the literature review (I: Achievement motivation and II: Academic confidence). Achievement motivation is defined as the motivation to work to achieve a goal and have a sense of accomplishment in the learning process. Academic confidence refers to a student's perception of the learning task and the student's convictions and expectations for success in the future. These expanded definitions formed the basis for creating items in the TL questionnaire.<sup>[13]</sup>

#### *Literature review and generating an item pool for the TL questionnaire*

A comprehensive literature review was conducted to identify various teaching methodologies. The aim was to design and develop a questionnaire that can be completed in a short time and covers all TL domains. Items were generated based on an extensive literature search and deductive reasoning by the authors. For example, an article discussed self-confidence amongst students,<sup>[14]</sup> based on which we included a similar item in our questionnaire as – The New (heutagogical) principles in teaching can increase creativity of the students and build confidence in them as compared to the current method of teaching.

#### *Scale*

The items in the questionnaire were formulated to elicit the participants' level of agreement with the items and rated using a five-point agreement scale that ranged from completely agree = 5, agree = 4, neither agree nor disagree = 3, not agree = 2 to completely disagree = 1.

### **Developing a preliminary questionnaire**

#### *Validity*

Our TL questionnaire was subjected to face and content validity based on standard guidelines.

#### *Face validity*

Two experts with long experience in teaching (>12 years) at medical institutions in India ascertained whether the content of the questionnaire was relevant to the study purpose and appropriate for the administration to medical students. They also assessed the design of each item (construction), clarity, and accuracy, and identified leading or confusing language for each item.

#### *Content validity and psychometric testing*

The qualitative and quantitative content validity testing was performed in two phases. The content validity index (CVI) and content validity ratio (CVR) were calculated.<sup>[15]</sup> The initial 35-item questionnaire version was presented for evaluation to 8 experts who consisted of faculty members from various medical teaching and research centres in India with 5–25 years of teaching experience and a special interest in medical education. Communication throughout the evaluation process was undertaken through e-mail and Google Forms, following best practices and guidelines from the literature.<sup>[16–18]</sup>

The CVI was evaluated, and the relevancy of each of the items was recorded as per standard guidelines.<sup>[19]</sup> Experts were requested to rate each item on a four-point Likert rating scale: The relevancy was recorded as 1 – not relevant, 2 – somewhat relevant, 3 – quite relevant, and 4 – highly relevant. The CVI formula is represented by CVI or % agreement = (Number of experts agreeing on items rated as 3 or 4)/(Total number of experts). A CVI score of 0.78 suggests acceptable content validity.<sup>[20]</sup> The necessity of items was also recorded for the calculation of CVR in a three-point Likert rating scale: 1 – not necessary, 2 – useful but not necessary, and 3 – essential. The CVR was computed for each item as follows:

$$\text{CVR} = [\text{ne} - (\text{N}/2)]/(\text{N}/2)$$

Where ne = number of experts indicating a measurement item is essential, and N = total number of experts who answered that item.

The Lawshe table reference was used to find the minimum CVR needed to retain the item on the scale.<sup>[21]</sup>

### **Data analysis**

#### *Exploratory factor analysis (EFA)*

All items of the final form of the TL questionnaire, consisting of main dimensions of achievement motivation and academic confidence, were analysed by EFA using the Statistical Package for the Social Sciences (SPSS) version 22 to assess the construct validity and reliability of items. The Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity for assessing the adequacy and suitability of data for factor

analysis.<sup>[18]</sup> Communalities ( $h^2$ ) were calculated to represent shared variance for which an  $h^2$  value  $>0.3$  was considered acceptable. Acceptable communalities range from 0.25 to 0.4, with ideal values  $>0.7$ .<sup>[22,23]</sup> To identify a group of related questions, EFA was carried out with the principal component analysis method, and factors with eigenvalues  $>1.0$  were retained.<sup>[24]</sup>

A graphical method in the form of a scree plot was used to help decide the number of meaningful groups (factors) extracted in a set of questions, and factor loadings of  $>0.4$  were considered acceptable, indicating that the question (item) fits well with that factor (group of questions).<sup>[22,23,25]</sup> The factor structure of our TL questionnaire was extracted using a varimax rotation. Anti-image correlations and correlation matrices were also investigated to see if the questions in the TL questionnaire are grouped effectively and show meaningful relationships while minimising the impact of other questions.<sup>[26]</sup>

### Reliability

The reliability of the questionnaire was assessed using measures of internal consistency and stability. To compute the internal consistency, the Cronbach's alpha coefficient was estimated. The acceptable value for the Cronbach  $\alpha$ -coefficient is considered  $>0.70$ , which points to the cohesiveness of the items in the questionnaire. The inter-correlation coefficient ( $>0.3$ ) of each item was used to decide which items contribute to the cohesiveness and should therefore be retained. To demonstrate the stability of the questionnaire, the intra-class correlation coefficient (ICC) was calculated and used to assess the level of agreement between scores from the first assessment (test) and after 14 days (re-test). A subsample of 10 students completed the questionnaire twice with a 2-week interval. For indicators of internal consistency, a corrected item-total correlation of  $>0.5$  was considered reliable.<sup>[27,28]</sup>

The initial version of the questionnaire included 35 items that were distributed across the dimensions – achievement motivation ( $n = 20$ ) and academic confidence ( $n = 15$ ), which was later shortened to 13 questions in the final questionnaire. Another change made during the development of the questionnaire was the rewording of the items (questions) to avoid confusion, ambiguity, or negativity.

### Second phase of the study

The TL questionnaire developed in the first phase assessed medical students' attitudes about the andragogical and heutagogical TL methods, which were applied during separate sessions covering 'Exercise Physiology' and 'Autonomic nervous system', respectively.

### Participants of the study

Convenient sampling was used where all 1<sup>st</sup> year medical students participated under the supervision of three faculty members. The inclusion criteria require the participants to be 1<sup>st</sup>-year medical students who gave consent to be a part of the research. This group of students was a homogeneous group of participants who had already completed 10 months of physiology training (both theory and practical). The students were informed of the research and its aims. Confidentiality and anonymity were assured, and their right to leave the project was explained, and consent for the use of the data was obtained.

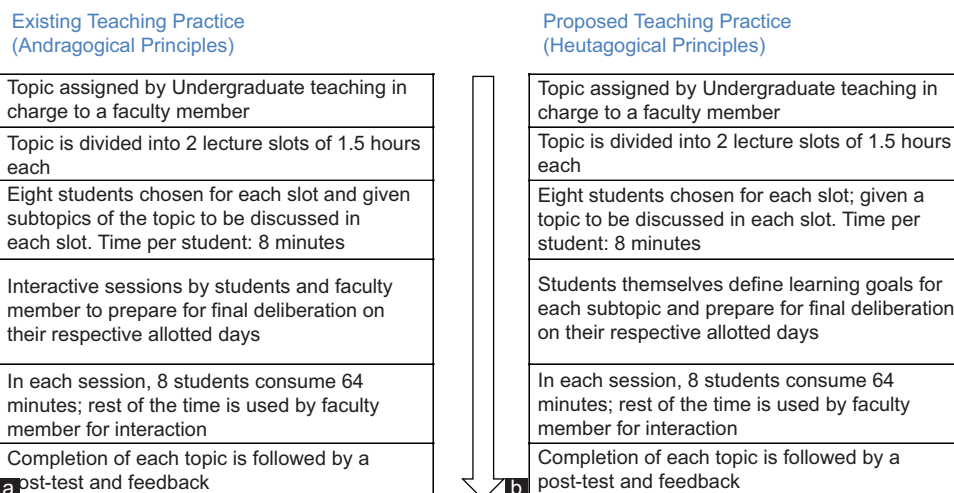
### TL practices followed in this study

A competency-based medical education framework has been integrated into the curriculum to strengthen medical training by focusing on developing essential competencies.

A TL method was introduced in our institute to enhance student engagement and active participation in theory classes for 1<sup>st</sup>-year MBBS students. This new method was meant to shift from traditional didactic lecture-based passive learning to an andragogical, more interactive and student-centred model. Two structured sessions were included, each lasting 1.5 h, focusing on teaching exercise physiology. These sessions were carefully designed and subdivided into smaller subtopics to encourage collaborative learning, peer discussions, and interactive problem-solving amongst the students. This practice required forming groups comprising eight students, each of whom was then given the responsibility to teach the rest of their classmates. The teacher facilitated the content delivery by the students in a formal lecture setting on 2 days (Style A). Three faculty members monitored the sessions, ensuring that the remaining students actively engaged with the subject matter rather than relying solely on passive note-taking. The teaching methods are explained in a flowchart [Figure 1a and Table 1].

For the present study, we implemented a slight modification of the ongoing TL approach to move towards student-determined learning, incorporating heutagogical principles that emphasise self-determined learning. In this revised model, students were given the autonomy to identify their learning needs, select relevant topics, and actively participate in the teaching process by conducting sessions themselves [Figure 1b].

To implement this approach, we organised two sessions, each lasting 1.5 h, focused on the physiology of the autonomic nervous system. Unlike traditional teacher-led instruction, these sessions followed a heutagogical learning model (Style B), where a group of eight students was given



**Figure 1:** Teaching styles used in this study. (a) Based on andragogical principles; (b) Based on heutagogical principles. Highlighted section denotes the main difference between the two methods. UG: Undergraduates

**Table 1:** Comparison of the two teaching–learning styles is presented to describe the experimental setup, differences in instructional strategies, student engagement and expected learning outcomes.

Parameter	Style A (Andragogical approach)	Style B (Heutagogical approach)
Teaching approach	Teacher-facilitated lectures	Student-determined learning
Session duration	1.5 h (exercise physiology)	1.5 h (autonomic nervous system)
Student participation	Group-based learning (eight students/group)	Students take charge of their learning process
Teacher's role	Facilitator, guiding discussions	Mentor, allowing autonomy in learning
Learning control	Predetermined syllabus and objectives	Students define their learning needs
Assessment	Post-tests after topic completion	Post-tests after topic completion
Feedback collection	5-question feedback from students	5-question feedback from students
Engagement level	Moderate (guided discussions)	High (active student involvement)
Expected learning outcome	Conceptual understanding through instruction	Deep learning, critical thinking and autonomy

only the broad topic and was then made responsible for subtopic division, content exploration, knowledge sharing, and peer teaching. At the same time, faculty members served as mentors, providing guidance and support as needed. This new method aligns towards a student-centred, self-determined learning paradigm to enhance critical thinking, problem-solving, and collaborative learning, fostering deeper engagement with the subject matter and improving knowledge retention amongst 1<sup>st</sup>-year MBBS students.

After each topic, a post-test assessment was conducted to evaluate students' understanding, retention, and overall performance in both TL styles – the andragogical (Style A) and heutagogical (Style B) approaches. These post-tests were designed to objectively measure conceptual clarity, critical thinking, and application of knowledge in the respective subject areas. The results were then analysed to compare the effect of both TL methods on learning outcomes.

As this study aimed to evaluate the effectiveness of this new TL approach, feedback was held at the end of each topic. Student feedback was collected through a structured questionnaire (based on Paul Ramsden's course experience questionnaire and Biggs' study process questionnaire) comprising six key questions, administered immediately after the completion of each topic. This feedback focused on various aspects such as the instructor's knowledge, conceptual clarity, engagement, instructor's preparation, depth of knowledge, and overall satisfaction with the teaching approach.<sup>[29,30]</sup>

### Statistical analysis

All statistical analyses were done using SPSS version 22. Descriptive statistics were used to summarise the results. The mean and standard deviations for these parameters were calculated for both teaching styles (A vs. B) and compared using the independent samples *t*-test (two-tailed). Differences were considered significant for values

of  $P < 0.05$  for all statistical analyses performed in this study.

## RESULTS

### First phase of the study

All eight experts invited to participate in the content validity completed and returned the relevance rating scale. The CVI and CVR for the entire tool were 0.81 and 0.56, respectively. Item CVI scores ranged from 0.22 to 1, and item CVR scores ranged from 0 to 1. Items presenting with a low CVI score (0.78) and a low CVR score (0.75) were removed from our preliminary questionnaire. The final questionnaire had 13 items after all qualitative and quantitative content validity analysis. The total CVI was 0.97 in the 13-item questionnaire, and the total CVR increased to 0.88 after the removal of the items.

After confirming the adequacy of the sampling based on the KMO and Bartlett's test of sphericity (KMO = 0.921 and  $\chi^2 = 1073.016$ ,  $P < 0.001$ ), EFA was performed, and two factors emerged with eigenvalues of  $>1$ , which accounted for 71.79% of the variance observed. The factors were as follows:

Items in the first factor included questions from 1 to 4, 6 to 7, and 12 to 13 that aimed to assess the achievement motivation with an item loading of 0.486, 0.839, 0.759, 0.868, 0.720, 0.864, 0.665, and 0.632, respectively, with an eigenvalue of 8.061. The second factor aimed to assess academic confidence and included questions numbers 5 and 8–11 with loadings of 0.621, 0.511, 0.920, 0.683, and 0.715, respectively, with an eigenvalue of 1.271 [Table 2]. The scree plot [Figure 2] also supports two factors. Communality values are acceptable, and the anti-image correlation matrix ranges from 0.819 to 0.969 and points to an acceptable correlation matrix [Table 3].

The Cronbach's alpha coefficient for the entire scale was 0.97 and ranged from 0.965 to 0.974 for both dimensions. The ICC = 0.96 (0.897–0.987) also indicated that the questionnaire has satisfactory stability. The values of Cronbach's alpha coefficients and the test–retest reliability of each item are demonstrated in Table 4. The corrected item-total correlation of all items in the questionnaire demonstrated a value above 0.30 [Table 4]. Similarly, the correlation matrix demonstrated acceptable values [Table 5].

### Second phase of the study

First-year MBBS students aged 18–20 years participated in the study.

The median and mode of the responses indicate that almost all participants favour the heutagogical way of teaching. The percentage distribution provides a finer picture of the areas that substantiate their feedback about the acceptance of a new method of teaching [Table 6].

**Table 2:** Factor analysis: Rotated factor pattern (two factors).

S. No.	Items	Factor 1	Factor 2
Q1	I am motivated to adapt to new learning systems to keep up with changing times	0.486*	0.407
Q2	The new approach improves the learning process of students, more, as compared to the current method of teaching.	0.839*	0.300
Q3	New method in teaching–learning motivates me for further studying in depth more as compared to the current method of teaching.	0.759*	0.354
Q4	The learning process is fun in the new method of teaching and learning is more as compared to the current method of teaching.	0.868*	0.324
Q5	The new principles in teaching can increase the creativity of the students and build confidence in them as compared to the current method of teaching.	0.533	0.621*
Q6	The new teaching improves interaction in the classroom as compared to the current method of teaching.	0.720*	0.455
Q7	The new method improves understanding in a better and efficient way as compared to the current method of teaching.	0.864*	
Q8	The new method of teaching requires knowledge of technology and available resources as compared to the current method of teaching.	0.307	0.511*
Q9	The new method decreases stage fear of students because they participate in teaching at a very early stage of their career as compared to the current method of teaching.		0.920*
Q10	The new pattern of teaching strengthens the problem-solving capacity of students as compared to the current method of teaching.	0.502	0.683*
Q11	The new pattern of teaching gives the students a chance to learn and imbibe good teaching skills as compared to the current method of teaching.	0.302	0.715*
Q12	The new pattern of teaching should be started right from the first MBBS for some topics as compared to the current method of teaching.	0.665*	0.445
Q13	The new approach increases and inculcates teamwork in the classroom as compared to the current method of teaching.	0.632*	0.485
Eigenvalues		8.061	1.271
% of the variance observed		62.011	9.774
*Item matched strongly with this factor			

**Table 3:** Anti-image matrices and communalities of the questionnaire.

Question	Communalities		Anti-image correlation
	Initial	Extraction	
Q1	0.505	0.423	0.925
Q2	0.775	0.790	0.945
Q3	0.732	0.703	0.932
Q4	0.844	0.857	0.915
Q5	0.744	0.673	0.895
Q6	0.721	0.728	0.969
Q7	0.766	0.771	0.913
Q8	0.419	0.388	0.945
Q9	0.740	0.831	0.819
Q10	0.728	0.715	0.944
Q11	0.634	0.601	0.895
Q12	0.695	0.638	0.922
Q13	0.680	0.635	0.942

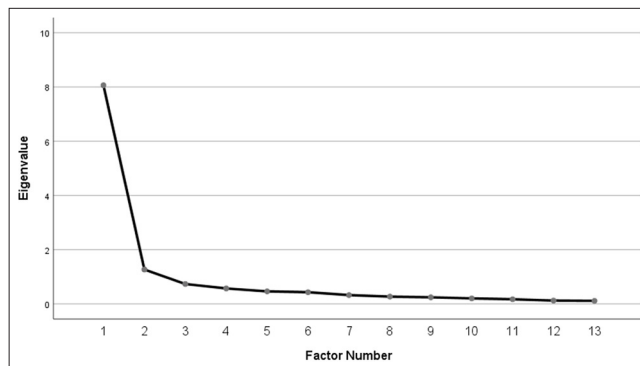
Extraction method: Principal axis factoring

**Table 4:** Item-total statistics of the questionnaire.

Question	Corrected item-total correlation	Cronbach's alpha if item deleted
Q1	0.751	0.970
Q2	0.904	0.966
Q3	0.921	0.966
Q4	0.837	0.968
Q5	0.876	0.967
Q6	0.857	0.967
Q7	0.733	0.970
Q8	0.454	0.974
Q9	0.943	0.965
Q10	0.924	0.966
Q11	0.930	0.965
Q12	0.841	0.968
Q13	0.870	0.967

As for the achievement motivation dimension, 72.7% of students reported that the heutagogical method motivates them to further study in-depth as compared to the traditional methods. About 62.7% of students felt that problem-solving capacity can be strengthened by heutagogical methods. About 62.8% of students felt motivated as their teaching skills would be improved through heutagogical methods.

For the dimension of building academic confidence, 76.8% of students felt that the heutagogical methods can increase creativity and build confidence. The results also reveal that 69.7 of students attribute an increased confidence to

**Figure 2:** The scree plot obtained for the teaching–learning questionnaire.

improved interaction in the classroom. Alongside, 70.8% of students feel that the heutagogical approach increases and inculcates teamwork in the classroom [Table 6].

Feedback taken from the students immediately at the end of each of the two sessions showed that a greater number of students (76%) agreed to recommend the use of the second teaching style (B) compared to 40% for the first teaching style (A). About 98% students were overall more satisfied with the second teaching style compared to 74% who were satisfied with the first teaching style [Table 7].

However, in contrast to feedback, the mean scores of the post-test were significantly higher in the session with andragogical (A) teaching compared to the second teaching style (B) (heutagogical) ( $P < 0.001$ ).

## DISCUSSION

Traditional didactic classroom teaching strategies do not adequately foster the competencies required in clinical contexts.<sup>[31]</sup> A need to transform the traditional education system has been felt, so several measures have been adopted at our institute to increase student participation and learning outcomes. An andragogical TL method is introduced wherein students participate in active teaching. In the present study, we tried to assess students' perception and compare the impact of the heutagogical TL pattern and built as an advancement over the andragogical approach, on the 1<sup>st</sup>-year MBBS students through a newly designed TL questionnaire and feedback from learning sessions.

The present study was conducted in two phases. In the first phase, psychometric validation was performed rigorously. CVI and CVR values (0.81 and 0.56, respectively) for preliminary instrument development were within acceptable limits. Some of the items were excluded due to suboptimal item-level validity scores. After refinement, the 13-item tool demonstrated strong content validity (CVI = 0.97 and CVR = 0.88), consistent with established

**Table 5:** Inter-item correlation of the questionnaire.

Question	Inter-item correlation												
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Q1													
Q2	0.714												
Q3	0.795	0.940											
Q4	0.545	0.893	0.809										
Q5	0.819	0.761	0.821	0.788									
Q6	0.552	0.749	0.808	0.729	0.753								
Q7	0.667	0.872	0.794	0.783	0.638	0.495							
Q8	0.405	0.403	0.434	0.345	0.275	0.411	0.308						
Q9	0.792	0.845	0.860	0.751	0.909	0.792	0.711	0.329					
Q10	0.713	0.795	0.852	0.701	0.866	0.911	0.618	0.313	0.958				
Q11	0.802	0.769	0.816	0.689	0.882	0.876	0.578	0.493	0.944	0.956			
Q12	0.556	0.757	0.695	0.802	0.725	0.697	0.734	0.488	0.839	0.784	0.810		
Q13	0.526	0.778	0.820	0.736	0.703	0.906	0.492	0.652	0.807	0.860	0.858	0.787	

**Table 6:** Students' perception of the teaching–learning questionnaire.

Question	Median	Mode	Mean	Standard deviation	Percentages				
					Strongly disagree	Neither agree nor disagree	Neither agree nor disagree	Agree	Strongly agree
Q1	5.00	5	4.37	0.852	3	6.1	0	38.4	52.5
Q2	4.00	4	3.59	1.134	7.1	11.1	17.2	45.5	19.2
Q3	4.00	4	3.73	1.096	5.1	12.1	10.1	50.5	22.2
Q4	4.00	4	3.48	1.155	8.1	11.1	23.2	39.4	18.2
Q5	4.00	4	3.95	0.962	3	5.1	15.2	47.5	29.3
Q6	4.00	4	3.67	1.212	10.1	7.1	13.1	45.5	24.2
Q7	4.00	4	3.48	1.11	5.1	17.2	18.2	43.4	16.2
Q8	4.00	4	4.04	0.832	2	3	11.1	56.6	27.3
Q9	4.00	4	4.11	0.978	3	4	12.1	40.4	40.4
Q10	4.00	4	3.75	0.993	4	6.1	22.2	46.5	21.2
Q11	4.00	4	3.96	0.914	4	1	16.2	52.5	26.3
Q12	4.00	4	3.43	1.271	12.1	10.1	21.2	35.4	21.2
Q13	4.00	4	3.71	1.197	10.1	5.1	14.1	45.5	25.3

recommendations.<sup>[19]</sup> EFA concluded with a two-factor structure: achievement motivation and academic confidence. The results confirmed the factorial validity of the scale and were supported by high communalities, strong anti-image correlations and eigenvalues exceeding 1. Internal consistency metrics were excellent (Cronbach's  $\alpha > 0.97$ ), and the test–retest reliability, as indicated by the ICC (ICC = 0.96), demonstrated high instrument stability over time.<sup>[32]</sup> A similar process has been shown for the development and validation of a questionnaire for learning in a blended learning (BL) environment and a questionnaire for the evaluation of clinical learning.<sup>[33,34]</sup>

In the second phase, a cohort of the 1<sup>st</sup>-year MBBS students evaluated the heutagogical method of teaching in comparison to the andragogical method. The response of the majority of students was positive, reporting increased motivation for in-depth study, improved problem-solving abilities and enhanced teaching skills. As demonstrated in other studies, our findings also demonstrated the core principles of heutagogy, such as learner autonomy, self-reflection and capability development over rote memorisation.<sup>[9,35]</sup> In addition, the aspect of academic confidence was reinforced, with students noting improved creativity, better classroom interaction and teamwork,

**Table 7:** Feedback from students for two teaching styles in the classroom immediately after the session.

	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
Feedback from students for the first teaching style in the classroom immediately after the session					
1. The instructors had an excellent knowledge of the lecture content	4	9	22	46	19
2. The instructors explained things clearly	5	9	35	36	15
3. The instructors made the lecture as interesting as possible	11	12	38	25	14
4. The instructors were well prepared an demonstrated in-depth knowledge of the topic allotted to them	4	10	32	39	15
5. I would recommend more such sessions	39	23	18	11	11
6. Overall I am satisfied with the session	8	18	36	29	7
Feedback from students for the second teaching style in the classroom immediately after the session					
1. The instructors had an excellent knowledge of lecture content	0	0	12	33	55
2. The instructors explained things clearly	0	0	14	53	33
3. The instructors made the lecture as interesting as possible	2	2	16	35	45
4. The instructors were well prepared an demonstrated in-depth knowledge of the topic allotted to them	0	0	10	35	55
5. I would recommend more such sessions	12	12	35	29	12
6. Overall, I am satisfied with the session	2	2	25	43	25

which are critical competencies in medical education and practice.<sup>[36]</sup>

Teichgräber *et al.*<sup>[37]</sup> explored the effectiveness of a heutagogical BL approach in medical education by applying a ‘flipped classroom’ model is a type of BL that reverses the traditional learning environment in which a self-directed learning phase (online videos for conceptual knowledge transfer) happens before the classroom attending phase (procedural knowledge transfer). This new BL approach was meant to explore topics in greater depth, impart skills and provide meaningful learning opportunities. The instructors noted that this novel approach better aligns learning objectives with clinical competencies, despite requiring more initial preparations. The study concluded that a heutagogical, multimedia-based teaching strategy enhances self-directed and collaborative learning amongst clinical radiology medical students.<sup>[37]</sup>

Despite the overwhelmingly positive student perceptions of the heutagogical approach, an important discrepancy was observed between satisfaction levels and learning outcomes. While 98% of students preferred the heutagogical session (Style B), the post-test scores were significantly higher in the andragogical session (Style A). This paradox suggests that while heutagogy enhances learner engagement and satisfaction, it may not immediately translate into superior performance on traditional assessments. Better performance in the andragogical method might also be due to different topics being covered in both methods and prior familiarity of students with the andragogical method. Difference in scores may also show the challenging situation for students

while adapting to self-directed learning paradigms, particularly when educational outcomes are measured through conventional testing formats.<sup>[38]</sup> For our group of students, the assessment method or framework may be more structured and aligned with andragogical methods, which may explain the higher test performance. Further, the long-term outcomes of heutagogy, such as critical thinking, adaptability and lifelong learning may be missed as the assessment focuses on short-term outcome measures.<sup>[39]</sup>

Teaching and learning practices worldwide are evolving to maximise benefits for students, the primary stakeholders. This shift is driven by the need to address limitations in existing TL practices, which leave students unprepared for the complexities and unpredictability of healthcare delivery and research requirements.<sup>[38]</sup> The increasing application of internet communication technology assignments in higher education sets the stage for the increasing popularity of heutagogical principles in TL. Enhancement of students’ engagement with public audiences through infographics, podcasts, the creation of blogs or social networking promotes heutagogy in TL and drives the adoption of its principles. Such a schema is highly suitable for ever-changing medical fields to develop new knowledge, devices, techniques and research into best practice.<sup>[40]</sup>

Further research is warranted to reproduce the factors determining students’ perspectives towards TL with a larger sample. By incorporating novel TL methods and strategies into medical education, new learners can be driven towards critical thinking to adapt to unforeseen challenges and tuned and trained to provide high-quality care. Our questionnaire

can act as a starting point to delve into deeper realms and domains of learning that can be used as a window through which the evolving learning needs of students can be identified and addressed.

### Limitations of the study

The present study assessed the impact of teaching methods over a limited time frame, which is inadequate to capture the long-term effects of these approaches on students' learning and retention of knowledge. A relatively small sample at a single centre restricts the general applicability of the findings to broader populations or in different educational settings. While convenience sampling allowed for practical feasibility, future studies should consider using sample size calculation based on statistical methods to enhance the findings' rigour, validity and reliability. Confounding variables such as prior knowledge, individual learning styles and external influences (e.g. personal circumstances and study habits) that were not controlled could affect students' perceptions and outcomes. Furthermore, the focus on only two specific topics – 'Exercise Physiology' and 'Autonomic Nervous System' – may not provide a comprehensive assessment of the effectiveness of the teaching strategies across the entire medical curriculum. Methodological limitations include comparing traditional pedagogical teaching methods and a confirmatory factor analysis, which was not done in the present study. We did not conduct tests for normality before performing EFA for questionnaire development due to the small sample size. Future studies may consider using identical content across both teaching approaches to more effectively isolate and identify the impact of the teaching method. The focus should also be on tracking the progression of students' learning and development over time to assess the enduring impact of heutagogical teaching methods on the overall academic journey and professional competencies.

### CONCLUSION

This study highlights the significance of integrating both heutagogical and andragogical teaching methods as they foster a dynamic and effective learning environment, though in entirely different realms. Most students favoured the heutagogical approach and attributed enhanced motivation and confidence to it, whereas the andragogical method helped them attain higher academic scores. The findings of our study underscore the need for a balanced approach that leverages the strengths of both TL methods to enhance students' autonomy and critical thinking while ensuring proficiency in the subject. There is often a variation in approaches to learning concerning different subjects and disciplines in medicine, surgery and allied branches.

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