

Medical Education

## Impact of Autonomous Learning for Advanced Acquisition of Physiology (ALAAP) module among undergraduate health-care professional students

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### ABSTRACT

**Objectives:** The present study aims to document the effectiveness of self-directed activity-based Autonomous Learning for Advanced Acquisition of Physiology (ALAAP) module for endocrine learning among undergraduate physical therapy students.

**Materials and Methods:** Fifty-five second semester students (28 males and 27 females) of the physical therapy course of a private healthcare university were recruited and the traditional didactic method of teaching-learning was compared with that of the newly developed ALAAP module.

**Results:** The triad approach employed to compare the scores of pre-test and post-test after the ALAAP module intervention showed  $P < 0.001$  and Hedges'  $g$  effect size of 0.75 with a 95% CI of  $-3.41$  to  $-1.5$  implying the effectiveness of the module to be strong. Furthermore, the feedback obtained was favourable toward this module and showed that there was an increase in both the affective and cognitive domains of learning.

**Conclusion:** ALAAP module for endocrine physiology is effective and positively targeted all types of learners. It helped their transition from pedagogy to andragogy type of deep learning. The group work done by the students as a part of this module instilled collaborative and cooperative learning in them.

**Keywords:** Experiential learning, Physiology, Teaching

### INTRODUCTION

Autonomous learning is a type of learning occurring from time immemorial. It is a well-treaded path since the times of Aristotle and Socrates and has been known to be highly efficacious with remarkable outcomes with regard to in-depth understanding and cognitive development. In the everyday life of a teacher, there arise many situations in the classroom wherein, giving scope for self-directed learning (SDL) to the students will enrich the learning experience rather than just reiterate the information. Experience is the founding stone for learning and education. Learning happens based on the experiences of the past and presents integrating with one's understanding, perception, and interpretation of the subject matter.<sup>[1]</sup> Thus, the role of a teacher as a facilitator allowing to explore, tread new paths, formulate queries, and test the hypothesis only becomes apt in this type of learning.

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Andragogy or adult learning is based on the fact that all humans are capable of unlocking their cognitive scaffolding and should be responsible for their own higher mental development.<sup>[2]</sup> In this digital era, there is no dearth of information and resources. The processes for doing an activity such as concept-based project charts include locating the resources, unravelling, and correlating the information. Preparing concept-based project charts can be mentally stimulating, enabling the attainment of a higher level of a deeper understanding of the topic and subsequent application of the knowledge in healthcare. The more the students feel pride in deducing the information, the more will be the feeling of empowerment and satisfaction which leads to further learning and thus affective domain synergises with cognitive domain by internalising the values to enhance the learning experience.<sup>[3]</sup>

Deeper learning can happen only if there is open-mindedness for other possibilities and avenues. The teacher as a facilitator here has an important role in building up learning communities that contribute significantly by elevating, empowering, and supporting each other to attain a transformative level of active learning. The present-day teaching-learning and assessment methods are mundane and concentrate more on didactic lectures and written tests where the student often regurgitates what has been just a superficial learning process. This approach is not sufficient for preparing the student as a future healthcare professional. Hence, the need of the hour is to shift the focus to more means of deeper integrated learning.<sup>[4,5]</sup> In addition, student involvement and interest in the routine summative assessment are on the decline. Even though few studies have shown the effectiveness of SDL,<sup>[6]</sup> not many studies exist for documenting its effectiveness in learning endocrine physiology, especially in allied health courses, who in the future will be one of the core team members of interprofessional approach in the delivery of healthcare.<sup>[7]</sup> There are very fewer studies in the Indian health education scenario done on allied health professional students to document the effectiveness of SDL in understanding the endocrine system. Hence, we decided to develop a SDL module and Autonomous Learning for Advanced Acquisition of Physiology (ALAAP module) on the endocrine system for undergraduate physical therapy students and explore its efficacy in comparison with the traditional teaching-learning method.

## MATERIALS AND METHODS

In the Bachelor of Physiotherapy (BPT) programme offered by the Physiotherapy College of a Private Deemed to be University of Dakshina Kannada, Karnataka, India, students learn physiology in their first two semesters of the course. Their curriculum includes didactic lectures, tutorials, and practical demonstration exercises.

The present study was a prospective interventional study done under the department of physiology. It was conducted following approval by the Institutional Ethics Committee.

### Sampling

ALAAP module integrates various teaching-learning techniques such as creative programmes, self-questioning, concept mapping, and problem-solving. While searching the literature, we found the corresponding standardised effect size for these interventions ranges between 0.63 and 0.64. We, therefore, decided to keep our expected standardised effect size (Cohens d) at 0.6.

We calculated the minimum sample size<sup>[8,9]</sup> using the formula:-

$$n = 2 \left[ \frac{(Z_{\alpha/2} + Z_{\beta})\sigma}{\delta} \right]^2$$

Keeping  $\alpha$  at 0.05 ( $Z_{\alpha/2} = 1.96$ ) and the power of test at 0.8 ( $Z_{\beta} = 0.842$ ) and  $d = \delta/\sigma = 0.6$ , we get  $n = 44.44 = 45$ . Adjusting for attrition, we randomly selected 60 s semester students of the BPT programme for the study. Among them, five students were excluded because of absenteeism. Fifty-five students (N), 28 male students (N1), and 27 female students (N2) completed the study module. Three students dropped out due to absenteeism and two students were unwilling to participate because of health issues. Participation was purely voluntary. Written informed consent was obtained from all the participants.

### Needs assessment

An open-ended questionnaire was used to understand the student's perspective and satisfaction toward the traditional teaching-learning methods employed. The questionnaire also captured their insights about the possibility of introducing new teaching-learning methods and their readiness toward it. The present batch of students was then sensitised regarding the different types of teaching-learning methods available and they were asked to determine the activity they would prefer to be used for learning endocrine physiology. The students came to a consensus on the project chart.

### Development and validation of ALAAP module

ALAAP module was developed after brainstorming by the team of faculty members and the specific learning objectives were listed. A definitive assessment technique for pre-module and post-module assessment with Yengage, an online learning management system based on ILIAS platform was prepared. Contents of the teaching-learning process with respect to the preparation of concept chart,

student presentation, and assessment pattern were finalised. ALAAP module was validated with experts in medical education.

### Pre-module assessment

All study participants were then taught endocrine physiology using the traditional teaching-learning method (didactic method). A pre-module assessment was then carried out to assess their knowledge.

Following the ALAAP module was implemented on the students. This was followed by post-module tests.

### ALAAP module

The ALAAP module was developed [Figure 1] based on the feedback obtained from the previous batch students, who had opined that it was difficult to comprehend and correlate the applied aspects of endocrine physiology with only didactic lectures as it is more clinical oriented.

### Forming of groups

After the pre-module assessment, 55 participants were grouped into 14 teams of four students each. The following team roles were assigned to the team members. Student 1: Collects all the relevant materials; Student 2: Outlines the chart design/layout; Student 3: Writes/draws the content into

the chart and Student 4: Project coordinator to coordinate the process and ensure timely submission.

### Concept-based project chart outline

Two weeks' time was given to the teams to prepare project charts with the following outline: Physiology of important hormones of various endocrine glands along with their applied aspects (Growth hormone, thyroid hormones, hormones regulating calcium, adrenal hormones: Cortisol, aldosterone, sex steroids, insulin, glucagon, somatostatin, posterior pituitary hormones: antidiuretic hormone and oxytocin). Clinical application-based physiology covering the following topics was also instructed to be included in the chart: Acromegaly/gigantism/dwarfism, Grave's disease, Cretinism/myxoedema, Rickets, tetany, Aldosterone escape phenomenon, Conn's syndrome, Cushing's syndrome, Addison's disease, diabetes mellitus, SIADH and diabetes insipidus.

### Criteria for concept-based project chart

Assessment of the charts prepared was based on relevance and originality of concepts, visual appeal, innovativeness, clarity of presentation, confidence, comprehension, and cohesive flow of ideas during presentation and response to queries, and the same was informed to the students. At the end of 1 week, students presented their project chart which consisted of a flow chart, printed pictures of the clinical features inpatient, diagrams, and concept map to the subject experts. Judging of the project chart was done by three faculty members.

### Post-module assessment

A post-module assessment containing the same 20 MCQs as a pre-module assessment was conducted on the next day of the presentation.

### Feedback on the module

Feedback from the students was taken to capture their perceptions toward the intervention.

### Statistical analysis

The pre-module score was compared with the post-module assessment score applying the Student's paired T-test using SPSS version 21.0.  $P < 0.05$  was considered to be significant. Feedback of the students on the ALAAP module was taken using Google forms on a Likert scale. The number of high performers (those scoring  $\geq 75\%$  marks) was plotted in a graph. The feedback responses of the students were then categorised under the cognitive domain, affective domains of learning, and learning experiences and have been presented as percentages.

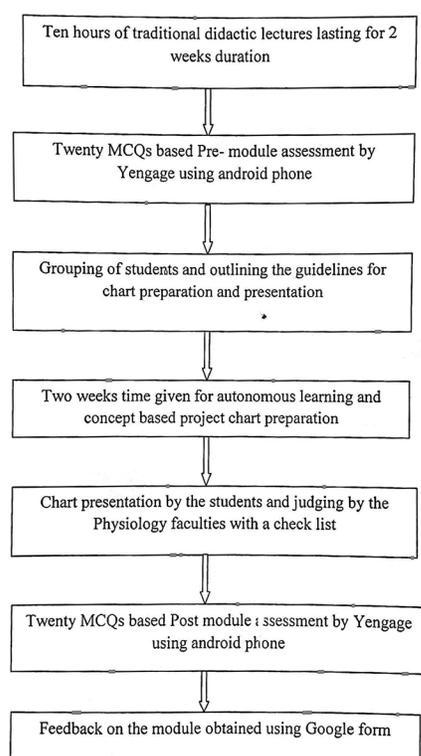


Figure 1: Flowchart of the ALAAP module.

## RESULTS

[Table 1] shows the gender and age distribution of the students. There was no statistically significant difference between the age distribution of the male and female students. [Table 2] shows the triad approach employed to compare the scores of pre-test and post-test after the ALAAP module intervention implying the effectiveness of the module to be strong ( $P < 0.001$ ). There was a significant increase in the number of high performers in the post-module online MCQ-based test when compared to the pre-module test [Figure 2]. The majority of the students agreed that the activity-based endocrine learning module enhanced their cognitive domain of learning [Table 3]. Based on the student responses, we could conclude that our intervention resulted in stimulation of the student's cognitive domain of learning. The majority of the students agreed that the activity-based endocrine learning module enhanced their affective domain of learning [Table 4]. The majority of the students opined that they had positive learning experiences from this module. Few students opined that this module was of no use to them and the time given for preparation was inadequate [Table 5].

## DISCUSSION

The present study aimed at studying the effectiveness of a self-directed study module called the ALAAP module

for learning endocrine physiology. As physiology is a basic science subject and forms the cornerstone for all healthcare professionals, a deep approach to active learning is very essential rather than a surface approach.

The first and foremost duty of a healthcare professional is toward patient care and safety. With the world moving toward an interprofessional approach to healthcare,<sup>[10]</sup> we must strive to equip allied health students with better knowledge in all fields of medicine. By improving the academic performance of allied health students, we can ensure a better contribution; smooth functioning, and fruitful role of these professionals during the interprofessional approach to healthcare.

First-year of undergraduate physical therapy course work is very crucial, as this is the time of transition of the learner from pedagogy to andragogy type of learning. They must adapt to learning the medical subjects in an adult fashion and hence it is the right time to gently mould and equip them to be a lifelong learner. It is also necessary to expose them to the right kind of learning experiences and thus facilitate them to be a lifelong learner. SDL of systems in physiology instils and promotes a sense of being autonomous and; being organised, self-disciplined, ability to communicate effectively, ability to accept constructive feedback, engage in self-evaluation, self-reflection, and keep up with the ever-evolving face of healthcare.<sup>[11]</sup> Pai *et al.* also found that SDL was an effective means of learning.<sup>[12]</sup> Their study was a case-based SDL and they also concluded that there is no additional benefit gained by supplementing SDL with the lecture to facilitate learning in physiology. In this context, a SDL module, the ALAAP module was planned and implemented.

**Table 1:** Demographic variables of the study participants ( $n=55$ ).

	Male N1 (%)	Female N2 (%)
Number of students ( $n=55$ )	28 (50.9)	27 (49.1)
Age in years (mean $\pm$ SD)	18.68 $\pm$ 0.77	18.37 $\pm$ 0.69

**Table 2:** Comparison of pre-test and post-test scores of the students after the ALAAP module ( $n=55$ ).

Scores	Mean $\pm$ SD	Mean difference	P-value	Hedges g effect size	95% Confidence interval of the difference	
					Lower	Upper
Pre-test	7.98 $\pm$ 2.79	-2.46	<0.001*	0.75	-3.41	-1.50
Post-test	10.44 $\pm$ 3.72					

SD: Standard deviation \* $P < 0.05$  – significant

**Table 3:** Student responses on cognitive domain of learning.

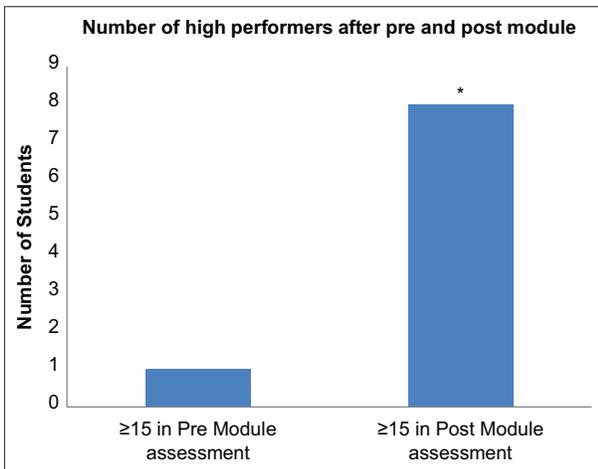
Items	Responses ( $n=55$ )				
	Strongly agree (%)	Agree (%)	Neither agree nor disagree (%)	Disagree (%)	Strongly disagree (%)
I feel this activity helped me in remembering the information better	18 (32.7)	20 (36.4)	14 (25.5)	1 (1.8)	2 (3.6)
I could understand the concepts clearly	8 (14.5)	24 (43.6)	18 (32.7)	3 (5.5)	2 (3.6)
This activity helped me in remembering the topics/concepts better	11 (20)	22 (40)	17 (30.9)	2 (3.6)	3 (5.5)

**Table 4:** Student responses on affective domain of learning.

Items	Responses (n=55)				
	Strongly agree (%)	Agree (%)	Neither agree nor disagree (%)	Disagree (%)	Strongly disagree (%)
I liked the activity-based learning for endocrine system	18 (32.7)	22 (40)	11 (20)	1 (1.8)	3 (5.5)
Activities make learning physiology interesting and enjoyable	27 (49.1)	10 (18.2)	14 (25.5)	2 (3.6)	2 (3.6)
It has improved my confidence in answering MCQs in summative exams	15 (27.3)	15 (27.3)	19 (34.5)	2 (3.6)	4 (7.3)
It has increased my interest in endocrine	18 (32.7)	19 (34.5)	12 (21.8)	3 (5.5)	3 (5.5)
It has increased my curiosity about the topic because of which I started reading different study material	11 (20.4)	18 (33.3)	18 (33.3)	3 (5.6)	4 (7.4)

**Table 5:** Learning experiences of the learners on the ALAAP module.

Items	Responses (n=55)				
	Strongly agree (%)	Agree (%)	Neither agree nor disagree (%)	Disagree (%)	Strongly disagree (%)
Such activities should be conducted for all topics in physiology	13 (23.6)	12 (21.8)	16 (29.1)	8 (14.5)	6 (10.9)
These activities should be conducted in addition to lectures	11 (20)	13 (23.6)	23 (41.8)	4 (7.3)	4 (7.3)
Activities are better than lectures	15 (27.3)	12 (21.8)	16 (29.1)	5 (9.1)	7 (12.7)
It was of no use to me	4 (7.3)	3 (5.5)	14 (25.5)	7 (12.7)	27 (49.1)
Time given for project preparation was inadequate	9 (16.4)	5 (9.1)	22 (40)	6 (10.9)	13 (23.6)



**Figure 2:** Number of high performers before and after self-directed study module of endocrine system (n=55).

Assessment completes the learning process and formative assessment is better than summative in mapping a student's progress of learning. The assessment is done after the ALAAP module showed a significant improvement in the average marks of the students. In addition, there was a significant increase in the number of high performers following the module.

Learning endocrine systems in physiology can be a tedious process and knowledge gained can be volatile with poor registration, perception, integration, retention, and recall. In our study, it was found that applying ALAAP to the endocrine system helped the physical therapy students in remembering and better understanding the concepts, as this module provided an opportunity to refer additional resources including visual clues and multimedia resources thus enhancing their ability to improve the cognitive domain of endocrine physiology.

The ALAAP module employed in our study enhanced the affective domain as portrayed in the feedback and was a positive learning experience because it provided a platform for the interactive student-centric approach of learning. Similarly, Walankar *et al.*, who conducted a cross-sectional study to determine the learning approaches on 435 physiotherapy students, found that 94.5% of students preferred the deep approach and concluded that multiple methodologies focussed on the student-centric approach will yield positive learning outcomes.<sup>[13]</sup> Innovative teaching-learning practices help facilitate deeper learning, create aptitude and interest in gaining knowledge. Thus, the affective domain synergises with the cognitive domain to enhance the learning experience.

With the advent of technology and tech-savvy 'Generation Z' students, it is imperative that we add on if not replace

the age-old and redundant methods of didactic lectures and summative assessments with more productive SDL methods and formative assessments. The ALAAP module used technology not only as a learning resource but also in the assessment. Undergraduates preferred multimodal learning strategies based on the type of learner, they are in learning medical subjects.<sup>[14]</sup> Using innovative and technology-friendly methods that cater to the needs of all kinds of learners including visual, auditory, read/write and kinaesthetic learners are the need of the hour.<sup>[15-17]</sup> The activity-based SDL module was well-received among the student community and improved the learning of all types of learners.

In our study, in addition to facilitating the innovative self-directed way of learning, students also experienced the effectiveness of teamwork and team dynamics in learning. This non-technical skill is an essential component of the overall development of healthcare professionals.<sup>[6]</sup> Teamwork enhances the quality of learning by promoting critical thinking, communication skills, fostering friendship, loyalty, and encouraging the development of accountability, role clarification, shouldering responsibilities, and working toward common goals. Learning can happen in a group through collaborative and cooperative learning.<sup>[18]</sup>

A minority of the students opined that lack of coordination was a hindrance to learning in the ALAAP module; the negative experiences can be attributed to both task-related factors such as group composition, contribution, and socio-emotional components such as conflict and group climate.<sup>[18]</sup> For a group member to perform well in a group, adequate time is essential for forming, storming, norming, performing, and adjourning the group.<sup>[19]</sup> Maybe the time given for group development was less which could have contributed as a hindrance to the student's (2%) learning and this also forms the limitation of our study.

## CONCLUSION

This study showed that the ALAAP module employed for second-semester physical therapy students was found to be significantly effective and has positively targeted all types of learners. It helped their transition from pedagogy to andragogy type of deep learning. The group work done by the students as a part of this module instilled collaborative learning in them. The effectiveness of this study was reflected in the significant improvement not only in the post-module assessment scores but also in the number of high achievers. The collective feedback obtained on the module from the students showed that the affective domain synergises with the cognitive domain by internalising the values to enhance the learning experience.

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## Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Smith SN, Crocker AF. Experiential learning in physical therapy education. *Adv Med Educ Pract* 2017;8:427-33.
2. Chacko TV. Emerging pedagogies for effective adult learning: From andragogy to heutagogy. *Arch Med Health Sci* 2018;6:278-80.
3. Lynch DR, Russel JS, Evans JC, Sutterer KG. Beyond the cognitive: The affective domain, values, and the achievement of the vision. *J Prof Issues Eng Educ Pract* 2009;135:47-56.
4. Dandannavar V. Effect of integrated teaching versus conventional lecturing on mbbs phase I students. *Rec Res Sci Technol* 2010;2:40-8.
5. Carvalho H. Active teaching and learning for a deeper understanding of physiology. *Adv Physiol Educ* 2009;33:132-3.
6. Shankar VM, Kutty K, Chacko T. Small-groups application-based learning approach (SABLA): From pilot to curricular change in physiology. *Indian J Physiol Pharmacol* 2018;62:479.
7. Tavakol K, Reicherter AE. The role of problem-based learning in the enhancement of allied health education. *J Allied Health* 2003;32:110-5.
8. McConnell MM, Monteiro S, Bryson GL. Sample size calculations for educational interventions: Principles and methods. *Can J Anesth* 2019;66:864-73.
9. Hattie J. The applicability of visible learning to higher education. *Sch Teach Learn Psychol* 2015;1:79.
10. Wellmon R, Baumberger-Henry M, Colby N, Knauss L, Fletcher P. Changing student attitudes toward interprofessional learning and collaboration: Evidence for the effectiveness of partnering with healthcare mentors in the academic setting. *J Allied Health* 2017;46:205-12.
11. Premkumar K, Vinod E, Sathishkumar S, Pulimood AB, Umaefulam V, Samuel PP, *et al.* Self-directed learning readiness of Indian medical students: A mixed method study. *BMC Med Educ* 2018;18:134.

12. Pai KM, Rao R, Punja D, Kamath A. The effectiveness of self-directed learning (SDL) for teaching physiology to first-year medical students. *AMJ* 2014;7:448-53.
13. Walankar PP, Panhale VP, Situt SA. Evaluation of learning approaches in physiotherapy students: A valuable insight. *J Edu Health Promot* 2019;8:25.
14. Rahman N, Alam T, Alam NN, Haque MZ, Alam T. Medical undergraduates preference in learning style: A single-institute experience from Bangladesh. *Kuwait Med J* 2017;49:12-6.
15. Breckler J, Yu JR. Student responses to a hands-on kinesthetic lecture activity for learning about the oxygen carrying capacity of blood. *Adv Physiol Educ* 2011;35:39-47.
16. Lujan HL, DiCarlo SE. First-year medical students prefer multiple learning styles. *Adv Physiol Educ* 2006;30:13-6.
17. Breckler J, Joun D, Ngo H. Learning styles of physiology students interested in the health professions. *Adv Physiol Educ* 2009;33:30-6.
18. Hammar CE. Group work as an incentive for learning-students' experiences of group work. *Front Psychol* 2014;5:558.
19. Tuckman BW, Jensen, MA. Stages of small-group development revisited. *Group Organ Stud* 1977;2:419-27.

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