



## **Use of Kinaesthetic Learning Skills among Slow Learners in Physiology to Improve Their Academic Performance**

**Devi R. Nithiya<sup>1</sup>, Suchita Palve<sup>2\*</sup>, Sachin Bhaskar Palve<sup>2</sup> and Arun Tipandjan<sup>3</sup>**

<sup>1</sup>*Mahatma Gandhi Medical College and Research Institute, Puducherry, Tamil Nadu, India.*

<sup>2</sup>*Symbiosis Medical College for Women, Symbiosis International (Deemed University), Pune, Maharashtra, India.*

<sup>3</sup>*International Centre for Psychological Counselling and Social Research, Puducherry, Tamil Nadu, India.*

### **Authors' contributions**

*This work was carried out in collaboration among all authors. 'All authors read and approved the final manuscript.'*

### **Article Information**

DOI: 10.9734/JPRI/2021/v33i34B31842

#### Editor(s):

(1) Dr. Sawadogo Wamtinga Richard, Ministry of Higher Education, Scientific Research and Innovation, Burkina Faso.

#### Reviewers:

(1) Vinu Sherimon, University of Technology and Applied Sciences, Oman.

(2) Gilberto Bastidas, University of Carabobo, Venezuela.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/69514>

**Original Research Article**

**Received 24 April 2021**

**Accepted 30 June 2021**

**Published 01 July 2021**

### **ABSTRACT**

**Background:** Kinaesthetic learning, a form of student-centric active learning technique, takes learning to the next level. Kinaesthetic learning enables better understanding and effective retention of information, especially among students who don't adapt to conventional teaching-learning techniques in large groups and isolated textbook learning.

**Methodology:** The present study was conducted for three consecutive years among Phase I MBBS students who needed additional curricular support. The students were divided into groups with 4 to 5 students each. They were offered topics to make either a 2D poster or a working model displayed in an exhibition cum competition. A feedback questionnaire was administered to the participants at the end of the competition.

**Results:** The majority of the students who participated either agreed or strongly agreed that the kinaesthetic learning technique facilitated them to read beyond the conventional textbooks and understand the concepts better. We also observed that the students reported increased confidence

\*Corresponding author: E-mail: [drsuchitrapalve11@gmail.com](mailto:drsuchitrapalve11@gmail.com);

to face the exam. Comparing the marks scored by the participants and the non-participants, the students who participated in the kinaesthetic learning exercise scored significantly higher than the non-participants ( $p=0.002$ )

**Discussion:** Kinaesthetic learning skills using 2D posters and 3D working models preparation helped to improve the academic performance among students in need of additional curricular care by enhancing their critical thinking skills and team-building capacity.

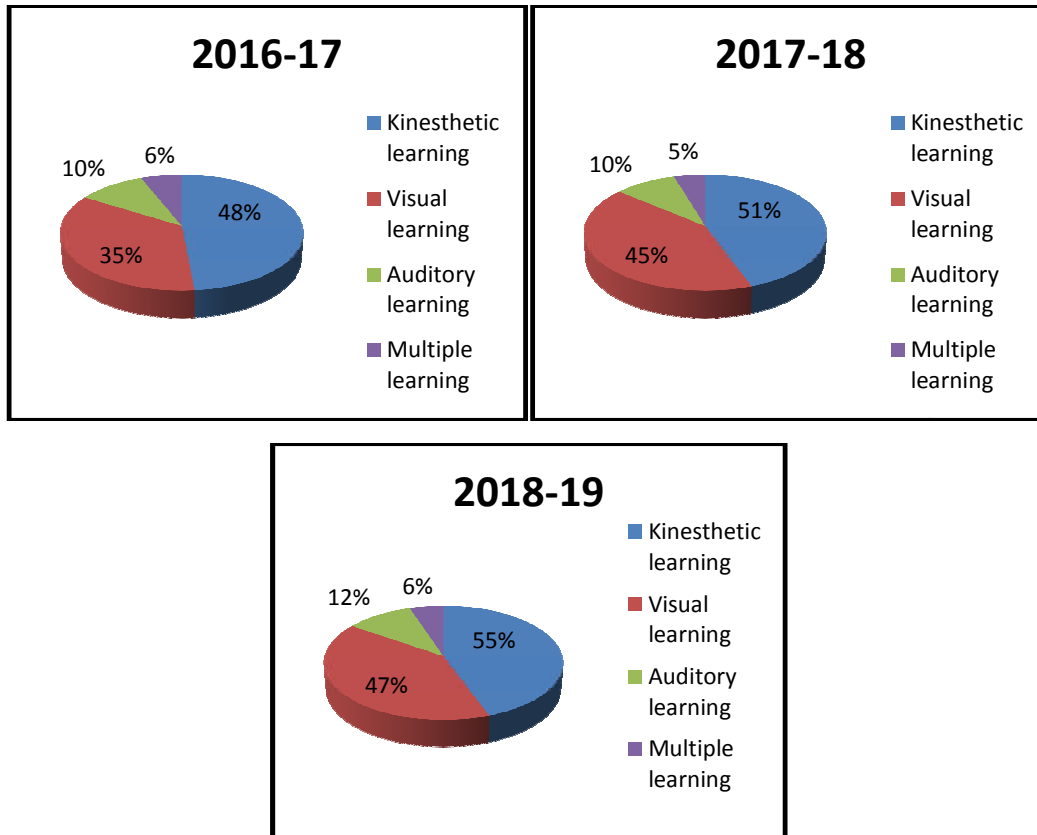
*Keywords: Academic performance; kinaesthetic; learning techniques; cluster formation; working model.*

## 1. INTRODUCTION

Physiology is a fundamental basic medical science that forms the undergraduate medical curriculum's foundation [1]. Medical colleges' teaching trend has seen a drastic shift from teacher-centered didactic lectures to learner-centered interactive learning methods [2]. We learn best when we combine the mind and body [3]. How the students learn can be categorized according to their learning preferences and style [4]. The instructor must consider the learner's preferred learning style for facilitating better learning outcomes [5]. The teacher instructs, and

the student's learning preferences can affect their academic progress [6]. It is imperative to acknowledge and create awareness about their learning styles among students, which will give them the satisfaction of learning the subject in a better way [7]

There are many articles and books which focus on the impact of learning style on effective learning [8]. Impulsive/ reflective learners, and holistic/analytical learners or learners with other learning styles [9]. The drawback with such learning style classification is that they classify learners into different groups leading to cluster



**Fig. 1. Epidemiological data on the medical students conducted for all three years**

formation. Interestingly, individuals have a combination of learning styles rather than a single method. The learning style hypothesis was derived based on crossover interactions of the individual's preferred learning models. Assuming the student to be aware of their learning requirements, instructions may be provided that best match the learner's learning style.

Despite decades of research on learning styles, it remains a mysterious element that has failed to make the much-needed progress to yield evident results with valid educational implications [10].

## 2. LITERATURE SURVEY

Researchers have reported that substantial changes need to be implemented in the curriculum, teaching, and assessment methods to improve medical education quality. Also, there is a need to identify student learning styles and approaches to ensure their academic progress. Learning preferences or styles influence how students focus, grasp, and remember new information. Our study chose to introduce kinaesthetic learning to our phase I MBBS students, an advanced level of active learning technique that facilitates an effective understanding of concepts and retention of information [11]. The kinaesthetic method helps inculcate the scientific attitude of learning among the students and develops cognitive and psychomotor domains to facilitate learning and retention. This active form of learning will kindle the students' interest in the students and promote their analytical skills [12]. For instance, preparing working models and 2D posters enable a better understanding of the core concept, develops a scientific attitude with prolonged retention of the topic or concept, and improves confidence among the learner. A thorough understanding and approach of the educators towards the students' learning preferences will help strengthen the teaching strategies and make the student's learning experience more enjoyable and interesting [13]. Students differ in their cognitive abilities, learning styles, motivation levels, and learning capacities. Kinaesthetic learning takes learning to the next level. It enables a better understanding and effective retention of information, especially among the students who tend to avoid conventional large group teaching and those who do not show interest in textbook reading [14]. Many times such students have better creative skills that go unnoticed. Since the conventional learning methods do not offer the desired outcome in such students, we have attempted to administer

kinaesthetic learning that is "learning by doing" using posters and 3D working models among the students who need additional curricular care [15].

## 3. METHODS

The present study was conducted among Phase I MBBS students in the Department of Physiology for three consecutive years (2016-17, 2017-18, and 2018- 19). A total of 184 students participated in the study from all three years.

### 3.1 Participants

The participants for this particular assignment/ learning method were selected based on the marks obtained in their internal assessment examinations (scores < 50% marks).

### 3.2 Type and Design of research

The method of study performed was cross sectional study where the students data was collected for 3 consecutive years among the 1<sup>st</sup> year medical students and the sample size were calculated through WHO statistical software, total of 184 students. The design of the study was based on questionnaires (Table.1) and internal assessment of the students marks which helped to categorize students to take up the kinesthetic model of learning and every steps of participants report were maintained confidentiality.

#### 3.2.1 Selection of the module/ topics

Students were divided into 12 teams with 4-5 members each. For the year 2016-17 and 2017-18 (n= 150) Endocrine module was assigned to the students. Students were allowed to choose their topics among growth hormone, acromegaly, thyroid hormone biosynthesis synthesis, hypothyroidism, diabetes mellitus, second messenger system, insulin metabolism, parturition, neuroendocrine reflex, stress, fertilization, pregnancy and lactation, negative feedback mechanisms, H.P. axis, Cushing's syndrome.

For the year 2018-19(n=34) Cardiovascular module was assigned and the topics covered were cardiac cycle, short term regulation of blood pressure, long term regulation of blood pressure, coronary circulation, fetal circulation, cutaneous circulation, neural regulation of blood heart rate, hemodynamics, ECG, shock and cardiac action potentials. Fig. 2 shows a 3D model demonstrating cutaneous circulation.

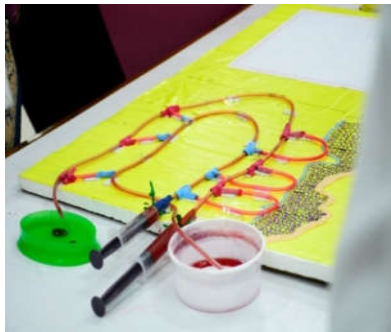
**Table 1. An outline of questionnaires of individual characteristics based on kinesthetic learners with sensory preferences**

<b>Kinesthetic learners</b>	<b>Favourable</b>	<b>Unfavourable</b>
Respond to physical attention of the students	05	11
Memorizing priority	20	25
Handwriting	17	06
Pointing by using fingers while reading	03	14
Manipulation	04	06
Movements	21	07
Other extracurricular activities	07	14
Total number of Questions	07	07

Fig. 3 shows a 3D working model demonstrating coronary arterial blood flow in the myocardial compared to normal infarction. A specific teacher was assigned to each group for proper guidance and support. The teacher helped the students identify appropriate learning materials and focus on developing the posters and models. Fig. 4 shows the 2D model of the HPA axis. Students were motivated to read and refer to different books to complete their models. Fig. 5 shows 3D the model of parturition.

Two weeks' time duration was given to complete the posters/ models using chart papers, thermocol sheets, cardboard sheets, batteries, colored liquids, syringes, electric bubs and wires, and other materials for preparing these models charts. The module coordinator was the overall in-charge of the activity.

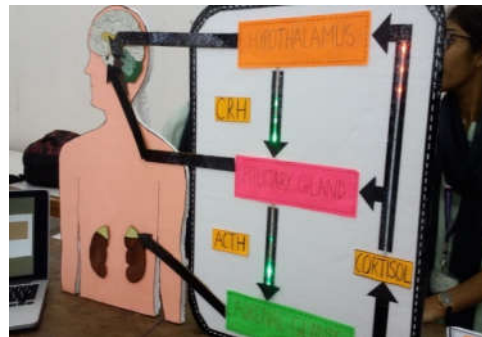
The exhibit cum competition was organized for all three consecutive years. The models and charts prepared by the students were displayed and judged by the senior faculties from other departments. Fig. 6 shows a 3D working model demonstrating factors affecting heart rate. Criteria for scoring were based on knowledge about the topic, presentation, and use of adequate resources. All the faculties and students from the university's constituent colleges were invited to witness this exhibit cum competition. Three winners were adjudicated and were awarded attractive prizes; all other participants were also given participation certificates.



**Fig. 2. 3D model demonstrating cutaneous circulation**



**Fig. 3. 3D working model demonstrating coronary arterial blood flow in myocardial when compared to normal infarction**



**Fig. 4. 2D model of HPA axis**

All the participants were administered a feedback form to evaluate their perception about kinaesthetic learning exercises on a 5 point Likert scale ranging from 1 as strongly disagree to 5 as strongly agree. Following these competitions, every year class test was conducted based on

the module as mentioned above, and marks were analyzed.

### 3.2.2 Inclusion and exclusion criteria

The inclusion criteria for the study was based on the demographic characteristics with the age group of 18 years as the 1<sup>st</sup> year MBBS students compared for three consecutive years from 2016-19 were taken for the assessment of kinesthetic study. The exclusion criteria was related to the models combined in the study of physiology as mentioned in section 3.2.2. On the basis of these criteria the results can be assessed as the impact of external validity.

### 3.2.3 Validation and reliability

Point biserial formula was used to measure the items validity and the Alpha Cronbach coefficient used to measure the reliability. Both validity and reliability were tested by statistic analysis using SPSS 18 for Windows.

## 4. DATA ANALYSIS

A significant difference was observed at  $p < 0.05$ . SPSS version 18 was used to analyze the data.

## 5. RESULTS

On analyzing the feedback of students to know if "preparing models by kinaesthetic learning helped me to understand a concept better," the majority of the students either agreed (53.1%) or strongly agreed (43.8%). For "kinaesthetic learning exercise helped me read textbooks beyond the need for examination," the majority of them agreed (68.8%); 18.8% strongly agreed; 9.4% neither agreed nor disagreed, and 3.1% disagreed. For "kinaesthetic learning exercise facilitated application-based learning of the topics," 59.4% of the students agreed, and 34.4% strongly agreed.

Apart from the majority of the students' academic benefits, kinaesthetic learning in groups is a unique technique that involves team-building and develops team spirit, and facilitates fun and enjoyment in the learning process. The majority of the students either agreed (53.1%) or strongly agreed (37.5%) that "Kinaesthetic learning improved the team learning spirit." In comparison, 6.3% of the participants neither agreed nor disagreed, and 3.1% disagreed with the above statement. For "Kinaesthetic learning facilitates application-based learning," the majority of the students either agreed (59.4%) or

strongly agreed (34.4%), and 6.3% neither agreed nor disagreed. For "Kinaesthetic learning is learning with fun," 56.3% agreed, 40.6% strongly agreed, and 3.1% neither agreed nor disagreed.



Fig. 5. 3D model of parturition



Fig. 6. 3D working model demonstrating factors affecting heart rate

All the participants either agreed (59.4%) or strongly agreed (40.6%) to "Kinaesthetic learning technique needs to be implemented in the upcoming years too."

For "Kinaesthetic learning had improved confidence in facing the examinations," the majority of the students either agreed (43.8%) or strongly agreed (31.3%) while 21.9% answered neither agree nor disagree and 3.1% responded strongly disagree in shown in Table 2.

The marks obtained in the class test were compared between the students who participated and those who did not participate in the kinaesthetic learning exercise. An unpaired t-test was used for the comparison. The students in the kinaesthetic learning exercise scored higher with a mean score of  $56.11 \pm 15.84$  compared to the non-participants who scored  $50.41 \pm 16.52$ . A statistically significant difference was observed with a p-value of 0.002.

**Table 2. Responses based on questionnaire was availed from the study participants in percentage (n=184) and its SD value has been determined**

Items	Strongly disagreed	Disagree	Neither agree nor disagree	Agree	Strongly agree	Mean±SD
	(1)	(2)	(3)	(4)	(5)	
Preparing models by kinaesthetic learning helped me to understand concepts better	0	0	3.1	53.1	43.8	4.40± 0.55
Kinaesthetic learning helped me read textbooks beyond the need for examination	0	3.1	9.4	68.8	18.8	4.03± 0.64
Kinaesthetic learning facilitates application based learning	0	0	6.3	59.4	34.4	4.28± 0.58
Kinaesthetic learning is learning with fun	0	0	3.1	56.3	40.6	4.37± 0.55
Kinaesthetic learning improved the team learning spirit	0	3.1	6.3	53.1	37.5	4.25± 0.71
Kinaesthetic learning activity should be continued in the coming years	0	0	0	59.4	40.6	4.40± 0.49
Kinaesthetic learning had improved confidence in facing the examinations	3.1	0	21.9	43.8	31.3	4.00± 0.91

### 5.1 Reliability of Kinaesthetic Learning

The tests obtained to find the reliability was performed by alpha cronbach coefficients of the questions. The results obtained from the kinaesthetic method of learning was tabulated. (Table 3).

**Table. 3 Reliability of kinaesthetic learning style**

Cronbach's alpha	No.of items
,747	7

### 5.2 Validity of Kinaesthetic Learning

Based on the test results of construct validity as much as two tests, obtained 5 items of valid statement distributed into 7 questions items for kinesthetic learning style (Table 4).

## 6. DISCUSSION

Learning preferences or styles help the student to focus, grasp and remember the new information in a better way. Teaching methods adopted by the teachers and the learning preferences of the students affect their academic progress. Medicine science is an ever-evolving field that continuously needs to be updated by

both the facilitator and the learner. As the medical curriculum demands delivery of a vast content in a limited period of time, new methods must be adopted for achieving expected outcomes. Updates in the curriculum have introduced a significant change in medical education, which has shifted the paradigm from traditional teacher-centered teaching-learning methods towards the use of interactive and problem-based student-centered teaching-learning techniques. The present new curriculum recommended by the medical council of India is more learners centered enhances the analytical thinking skills of the learner. Student-centered active learning methods are key requirements for a better understanding of the subject. The present generation is technically sound and more concepts oriented; they desire to learn more in less time using new methods. Kinaesthetic learning in association with muscle memory is a deeper learning approach rather than superficial study techniques that involve memorizing and reciting. In general, we learn best when we combine mind and body. A thorough understanding and approach of the educators towards learning preferences of the students will not only help to strengthen the teaching strategies but also makes learning experience of student more enjoyable and interesting.

**Table 4. Validity of kinaesthetic learning styles**

		Validitas
VAR00001	Pearson correlation	,468
	Sig. (2 tailed)	,000
	N	7
VAR00002	Pearson correlation	,492
	Sig. (2 tailed)	,000
	N	7
VAR00003	Pearson correlation	,508
	Sig. (2 tailed)	,000
	N	7
VAR00004	Pearson correlation	,515
	Sig. (2 tailed)	,000
	N	7
VAR00005	Pearson correlation	,523
	Sig. (2 tailed)	,000
	N	7
VAR00006	Pearson correlation	,552
	Sig. (2 tailed)	,000
	N	7
VAR00007	Pearson correlation	,563
	Sig. (2 tailed)	,000
	N	7

Kinaesthetic learning requires students to read beyond their textbooks by searching for materials and processing the appropriate information using complex cognitive abilities to extract and organize contents to design their models and posters. The advantage of the methodology in our study is that students were not completely let to prepare on their own. Rather each group had a faculty to moderate the information gained and processed by the students for the development of working models and posters. Kinaesthetic learning guided by moderators combined with motivation and self-enthusiasm to learn along with teamwork is the key concept of success in our study. The guided shift from andragogy to heutagogy employing developing models and posters helps students to learn with focus and interest.

Such a teaching-learning method with shared control between the teacher and the student facilitates the student to avoid overwhelming frustration to choose from an ocean of information to work on their target.

Guided active learning using a kinaesthetic technique by developing models and posters helps learners select tasks with second-order scaffolding that ensures selecting appropriate study material and adopting relevant task practice.

Feedback from the students towards kinaesthetic learning has been recorded to evaluate their perception of this active learning technique. The reliability of assessment of learning styles using questionnaires offered to students has been questioned by many researchers because students may not be aware of their learning styles.

Hence, in our study, we didn't stop with students' perception. The evaluation was in the form of an internal assessment on the concerned topics included for model competition. Limited autonomy in learning techniques and the assessment of the topics by conventional methods have shown improvement in students' academic performance in our study as hypothesized.

Considering the students' active participation, involvement, and interest in participation in a kinaesthetic learning exercise, our study findings are similar to that of Jayanti Pant and her associates. They attempted to understand the effect of "working model-making activity" for first-

year undergraduate medical students. Pant observed that students reported such activity to be interesting and useful for understanding the subject better.

The students who underwent the kinaesthetic learning exercise scored significantly higher than the non-participants for all the consecutive years. These findings follow the findings of kinaesthetic learners who opt for deeper learning strategies and hence perform better academically.

Newble and Entwistle, in their research, have reported that to improve the quality of medical education, substantial changes are needed to be made in the curriculum, assessment, teaching. Also, there is a need to identify student learning styles and approaches to ensure their academic progress. Each student differs with the learning style, the approach, the way he/she is motivated, or the individual learning capacities.

Kinaesthetic learning, a form of student-centric active learning technique, takes learning to the next level and enables better understanding and effective retention of information, especially among students who don't adapt themselves to conventional teaching-learning techniques, group teaching, and isolated textbook learning.

Several studies were conducted to analyze the benefits of active learning strategies among the learner. Our study attempted to study the perception of students who needed additional-curricular care towards kinaesthetic learning and analyzed the effect of a kinaesthetic learning exercise in academic performance by conducting an assessment of the respective modules.

## 7. CONCLUSIONS

In our study, the target population was the students who needed additional curricular support. Feedback from these students revealed that they read the subject in a detailed manner while working or creating the models. As the students were divided into groups, it helped them understand the idea of think- pair- share- create a working model/ poster for a particular topic. The students in the kinaesthetic learning exercise scored higher as compared to the non-participants. A thorough understanding and approach of the educators towards the students' learning preferences will help strengthen the teaching strategies and Active learning



techniques accompanied by guidance and moderation by a teacher help the students focus on the target, understand the subject better, improve their academic performance, and enhance their critical thinking skills and team-building capacity. While conducting these activities for three consecutive years, we found that such activities need more planning and motivation, not only for the students but also for the faculty to actively conduct such active learning exercises. The learning material should be provided to the learner well in advance for ensuring active involvement.

### LIMITATIONS OF THE PRESENT STUDY

The student's active initiation was not seen due to other academic commitments. There were issues with time constraints, and sometimes students were discouraged by their own group members. Since such activities were not a part of the routine curriculum lot of time was consumed in planning and management, and also, more time was taken to analyze the feedback for improvement so that the changes can be made for the upcoming batch of students.

### CONSENT

After explaining the study, informed consent was availed from all the participants.

### ETHICAL APPROVAL

Ethical clearance taken from Mahatma Gandhi Medical College and Research Institute, Puducherry, India.

### ACKNOWLEDGMENT

The author would like to thank Mahatma Gandhi Medical College Hospital and Research Institute, Sri Balaji Vidyapeeth, for their permission and extended cooperation for the effective conduct of this study.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### REFERENCES

1. Kumar LR, Voralu K, Pani SP, Sethuraman KR. Association of kinesthetic and read-write learner with deep approach learning and academic achievement. *Canadian Medical Education Journal*. 2011;2(1):23-7.
2. İlçin N, Tomruk M, Yeşilyaprak SS, Karadibak D, Savcı S. The relationship between learning styles and academic performance in TURKISH physiotherapy students. *BMC medical education*. 2018;18(1):1-8.
3. Bhattacharyya E, Sarip AB. Learning style and its impact in higher education and human capital needs. *Procedia-Social and Behavioral Sciences*. 2014;123:485-94.
4. Newble DI, Entwistle NJ. Learning styles and approaches: implications for medical education. *Medical education*. 1986;20(3):162-75.
5. Fleming ND, Mills C. Not another inventory, rather a catalyst for reflection. *To improve the academy*. 1992;11(1):137-55.
6. Leppink J. Science fiction in medical education: The case of learning styles. *Journal of graduate medical education*. 2017;9(3):394.
7. Kirschner PA, van Merriënboer JJ. Do learners really know best? Urban legends in education. *Educational psychologist*. 2013;48(3):169-83.
8. Kolb DA. *Experience as the source of learning and development*. Upper Sadle River: Prentice Hall; 1984.
9. Berkson L. Problem-based learning: have the expectations been met?. *Academic medicine*; 1993.
10. vanHout-Wolters B, Simons RJ, Volet S. Active learning: Self-directed learning and independent work. *In New learning*., Springer, Dordrecht. 2000;21-36.
11. Gibbons P. *Scaffolding language, scaffolding learning*. Portsmouth, NH: Heinemann; 2002.
12. Veenman MV, Prins FJ, Verheij J. Learning styles: Self-reports versus thinking-aloud measures. *British Journal of Educational Psychology*. 2003;73(3):357-72.
13. Stefanou CR, Perencevich KC, DiCintio M, Turner JC. Supporting autonomy in the classroom: Ways teachers encourage student decision making and ownership. *Educational psychologist*; 2004;39(2):97-110.
14. Pandey A, Prakash G. Deduplication with Attribute Based Encryption in E-Health Care Systems. *International Journal of MC Square Scientific Research*. 2019; 11(4):16-24.

15. Anderson LW, Bloom BS. A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman; 2001.

© 2021 Nithiya et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<http://www.sdiarticle4.com/review-history/69514>