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CASE BASED LEARNING IN MICROBIOLOGY AMONG INDIAN MEDICAL UNDERGRADUATES

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Abstract:

- Microbiology is a highly volatile subject dealing with microbes and infectious diseases. The conventional method of teaching being not the satisfactory, henceforth C**ase Based Learning**, an innovative interactive teaching learning methodology used as a teaching tool for **better retention** and also promote **high order analytical skill** in the learners by **correlating the basic sciences with clinical case scenarios**. This also improved the performance of the learners and**enhanced the problem-solving skills** with **deeper conceptual understanding of the subject**. The **cross- sectional study** conducted in the department of Microbiology for **Phase II MBBS students** to evaluate and assess the improvement of performance and problem-solving skills of the students after implementation of CBL module. The **paper cases** were used as **CBL module** for the selected topics with relevant clinical history and case findings. **Pre and post-test** conducted to assess the performance and module was evaluated by using **feedback questionnaire** with **Likert scale** and **faculty** was also **interviewed** regarding its implementation. **Paired t- test** was used to compare the pre and post test scores after the implementation of CBL module and **p- value** obtained was **less than 0.0001** which was statistically **highly significant.** The results of the present study were **correlating with the previous studies**. It has been concluded from the present study that **CBL** helped in the **better retention** of the subject and also helped the learner in deeper conceptual understanding of the subject. It alsoenhanced the **problem-solving skills** in the learners by **clinical context** so this methodology should be **adopted in the teaching curriculum** benefitting the undergraduates.

Keywords:

CBL (Case Based Learning), CBME (competency based medical education), MCQs (Multiple Choice Questions)

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Introduction:

Microbiology as a subject dealing with microbes and infectious diseases. The conventional method of teaching with didactic lectures restricted to classroom setting mainly and is highly volatile. As per **competency based medical education (CBME)**, there is need to change the curriculum [(1)] to create Indian Medical Graduates clinically competent and globally relevant. [(2,3)] Henceforth the **new innovative teaching methodologies** need to be introducedin practice for better outcome.

The **case-based learning** is a type of **adult learning** that develops **problem solving skills** among learners and also helps the learners in **correlating** the knowledge of Microbiology as para- clinical subject in **diagnosing and interpretation** of clinical encounters later on. Studies have shown that Microbiology discussed by case-based learning approach leads to improve understanding and clinical comprehension of the subject. [(4)] This type of learning exposes the learners to **real life patients** early in the curriculum and also motivates them by orienting thelearners to analyze and solve different clinical scenarios which will help them to get better understanding of the subject in a better interactive way.

Previous methodology of teaching the Microbiology was organism based only but case scenario-based learning of Microbiology, **interpretation of laboratory reports**, understanding of **antibiotic resistance pattern of pathogens** emphasizes on the clinical and **applied aspectsof the disease** is imperative to bridge the gap between theory and practice. [(5)]

Case based learning can be done by using **paper cases** containing relevant clinical scenarios is inexpensive also. CBL also uses **virtual trigger cases** to create interest in a particular area of curriculum. **CBL also function as a bridge between knowledge and practical life**. It promotes active discussion and participation of students. It also facilitates the development of **reflective thinking** and deeper conceptual understanding and also promotes the **analytical thinking** and problem-solving skills of the learners.

Aims and Objectives:

1. To prepare CBL module
2. To implement case-based learning as a teaching tool
3. To evaluate the implementation of CBL module by students and faculty
4. To assess the improvement of performance and problem-solving skills

Methodology:

Study type: cross sectional study

Study duration: 11 months

After seeking permission from institutional ethical committee and research the study conducted in the department **of Microbiology at ASCOMS & Hospital Jammu** over the period of 11 months **for phase 2 MBBS students**. The **two topics** from the competencies provided NMC guidelines selected for case-based learning and modules prepared **for topic1- MI3.5 Food Poisoning and topic 2- MI 3.7 Viral Hepatitis**. Two modules were prepared with the help of clinicians and subject experts. **The paper cases** including relevant history, physical examination, laboratory findings framed with the help of subject expert. The faculty

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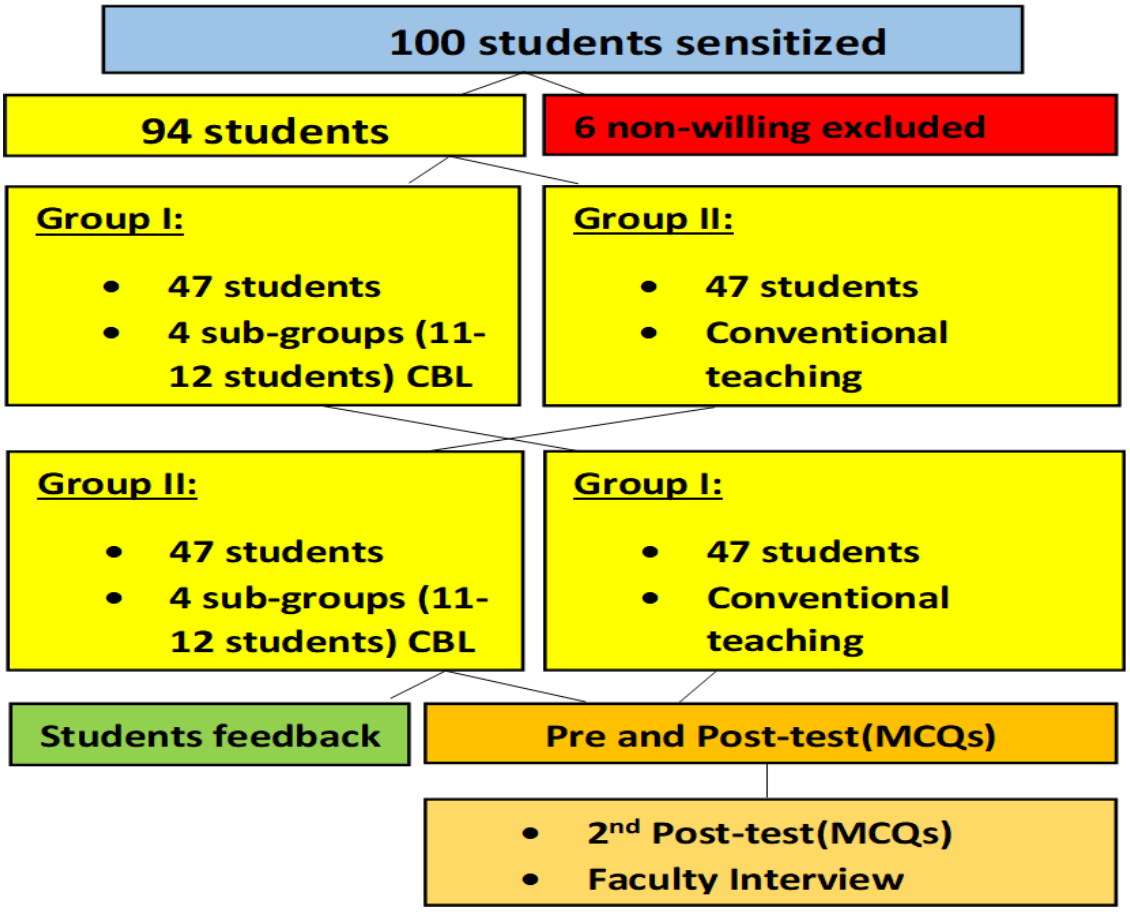
as well as students were sensitized towards case-based learning. Paper cases handed over to the facilitators prior to the session and briefing of the students regarding upcoming sessions done.

Inclusion criteria: 100 students enrolled for Phase II MBBS were sensitized but **94 students** actively participated.

Exclusion criteria: **6 non willing students** due to some reasons did not participate.

Batch of 94 students was divided **into 2 main groups of 47 students each.** One group subjected to conventional method of teaching and other **group divided into 4 small sub groups of 11- 12 students** each for CBL module implementation and vice- versa. Brainstorming of the students done with case scenarios. One facilitator provided to each small sub group. Facilitator only facilitate the guided discussion. No prompt lecture delivered for these cases and the session was concluded by group discussion**. Pre- and post- test** containing subject related multiple-choice questions of students conducted to assess the learning of the students. Students were also evaluated for implementation of case-based learning by **using feedback questionnaire with the Likert scale of 1-5 with minimum1 and maximum 5**. Faculty was also interviewed for implementation of case-based learning methodology with open andclose ended question



Flow diagram of Methodology

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Observations and Results:

This study implemented CBL as a teaching tool in Microbiology among phase-II MBBS students. **SPSS version 20** was used for statistical analysis. **Paired t- test** was used to compare pre and post test scores obtained by the students after conventional teaching and CBL implementation. Pre -test is the reflection of the previous knowledge and post-test scores were collected after implementation of CBL**. P-value obtained less than 0.0001was highly significant statistically.**

Table1: Comparison between pre-test and post-test scores of Module1: Food Poisoning by Conventional method.

Scores	Mean	Standard deviation	P value
Pre- test	2.68	0.96	0.0001
Post- test	5.51	0.88	

Table2: Comparison between pre-test and post-test scores of Module1: Food Poisoning after CBL implementation.

Scores	Mean	Standard deviation	P value
Pre- test	3.43	1.43	0.0001
Post- test	7.98	1.09	

Table3: Comparison between pre-test and post-test scores of Module2: Hepatitis by Conventional method.

Scores	Mean	Standard deviation	P value
Pre- test	2.34	0.98	0.0001
Post- test	5.85	0.69	

Table4: Comparison between pre-test and post-test scores of Module2: Hepatitis after CBLimplementation.

Scores	Mean	Standard deviation	P value
Pre- test	3.4	1.75	0.0001
Post- test	8.09	1.41	

Table5: Post-test scores of Conventional & CBL method.

Post-test Scores	Mean	Standard deviation	P value
Conventional	5.68	0.81	0.0001
CBL method	8.03	1.26	

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Table6: Comparison between Post-test scores immediately and after 4 weeks of Conventional method.

Post-test Scores	Mean	Standard deviation	P value
Immediately	5.68	0.81	0.0001
4 weeks after conventional.	2.47	0.92	

Table7: Comparison between Post-test scores immediately and after 4 weeks of CBL implementation.

Post-test Scores	Mean	Standard deviation	P value
Immediately	8.03	1.26	0.0001
After 4 weeks of CBL implementation	6.63	1.38	

Table8: Comparison between Post-test scores after 4 weeks of conventional & CBL implementation.

Post-test Scores	Mean	Standard deviation	P value
After 4 weeks of conventional method.	2.47	0.92	0.0001
After 4 weeks of CBL implementation	6.63	1.38	

Table9: Percentage of students after implementation of module.

Post-test score	Conventional method	CBL
Less than 25%	0	0
26- 50%	38 (40.42%)	0
51- 60%	42 (44.68%)	10 (10.63%)
61- 75%	14 (14.89%)	27 (28.72%)
More than 75%	0	57 (60.63%)

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Fig:1 Percentage of students score showing improved problem skills.

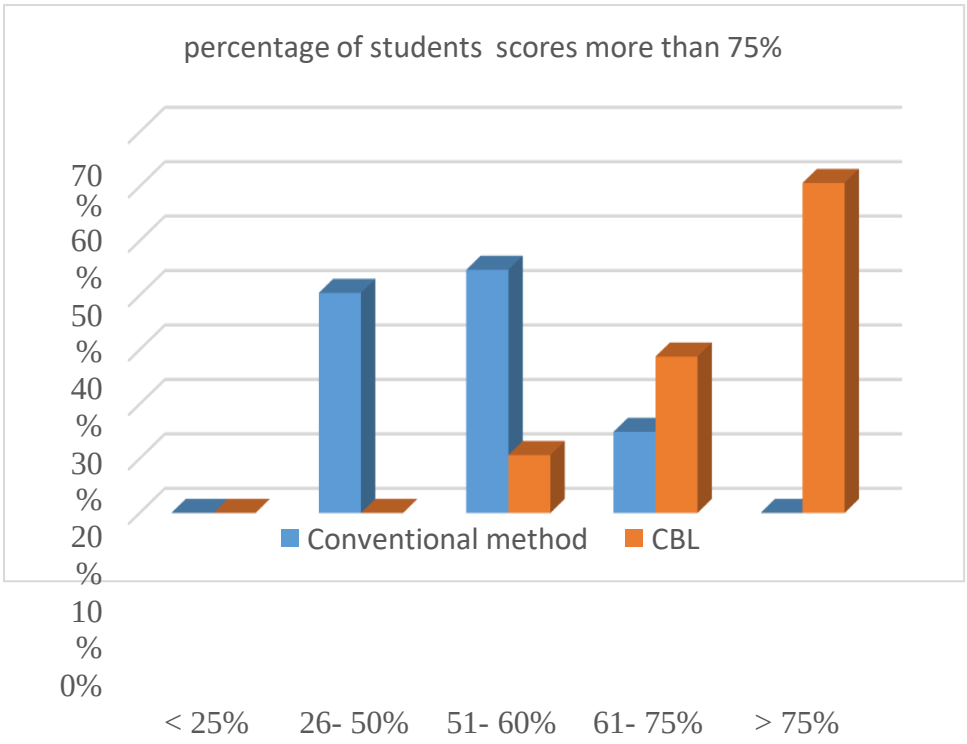

Table 10: Percentage of students scoring more than 60% after implementation of module.

Post – test score	Conventional method	CBL
Less than 60%	80 (85.10%)	10 (10.63%)
More than 60%	14 (14.89%)	84 (89.36%)

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Fig.2: Percentage of students correlating basic sciences with clinical scenarios after CBL implementation.

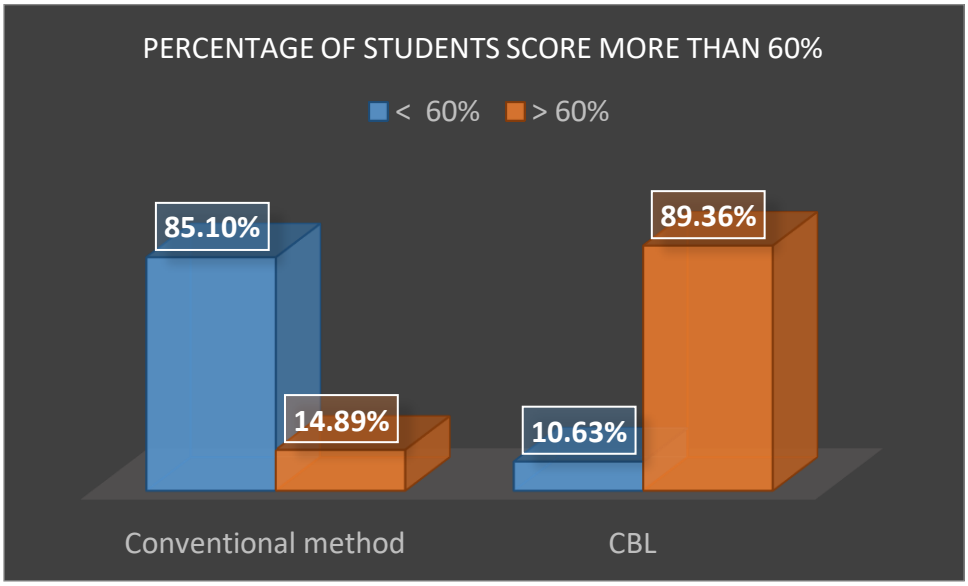
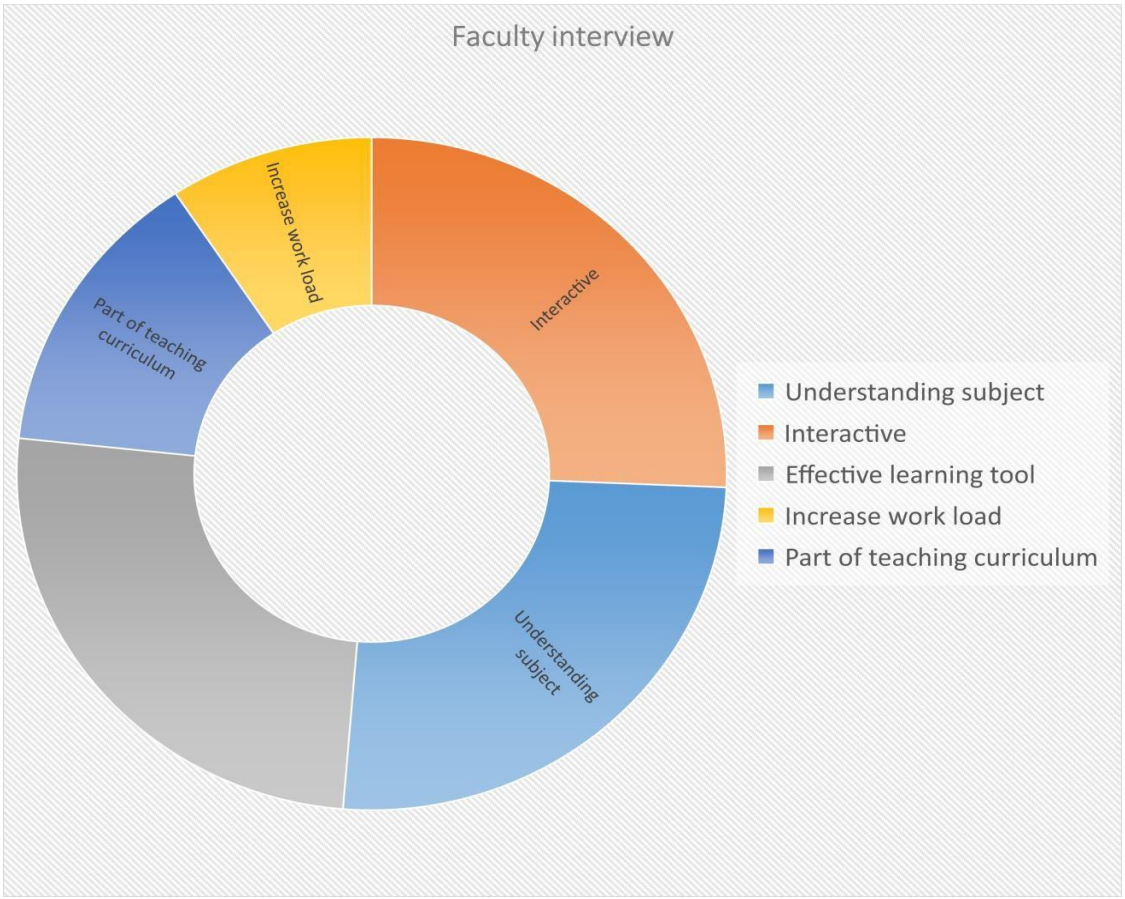


Fig.3: Faculty interview in percentage regarding the implementation of CBL module.



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Evaluation of Feedback Questionnaire for students:

S.No.	Questionnaire	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1.	CBL method of teaching is more attractive way of teaching	0	1 (1.06%)	13 (13.82%)	43 (45.74%)	37 (39.36%)
2.	This methodology is more useful in the retention of the subject.	0	1 (1.06%)	10 (10.63%)	49 (52.12%)	34 (36.17%)
3.	I am satisfied with CBL method of teaching.	0	0	9 (9.57%)	13 (13.8%)	72 (76.59%)
4.	This type of teaching will help in better correlating the basic sciences with clinical scenarios.	0	0	8 (8.51%)	40 (42.55%)	46 (48.93%)
5.	This method will help to improve the problem solving skills	0	0	6 (6.38%)	47 (50%)	41 (43.61%)
6.	Do you thinkthis will improve the teamwork?	0	2 (2.12%)	4 (4.25%)	40 (42.55%)	48 (51.06%)
7.	Do you think this should become a part of teaching curriculum?	0	2 (2.12%)	7 (7.44%)	35 (37.23%)	50 (53.19%)

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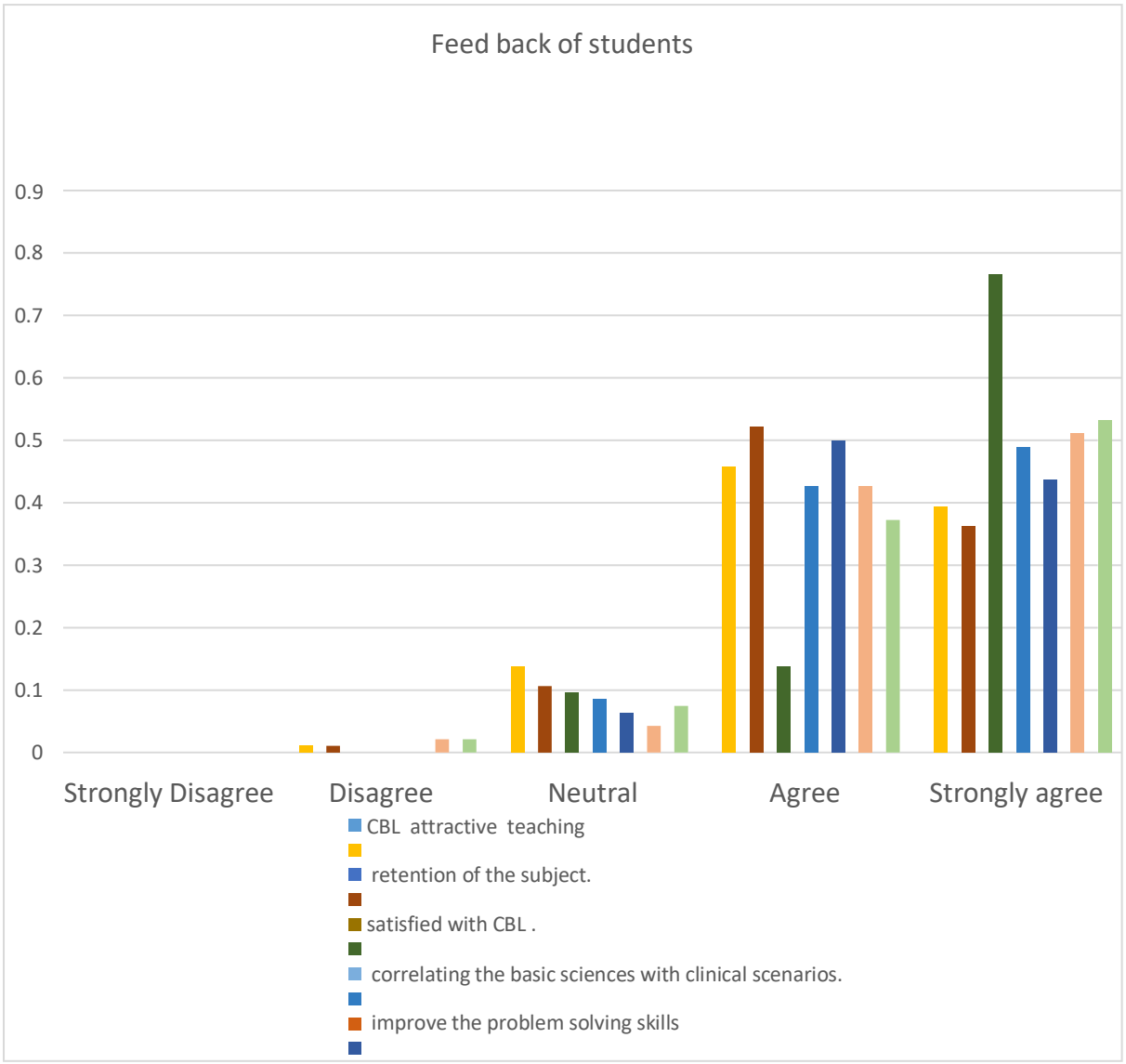
Fig.4: Feedback of the students in percentage regarding the implementation of CBL module.



Discussion:

Medical schools around the globe are adopting various interactive teaching methods to enhance learning and retention and to inculcate self- directed learning skills in medical students.[6] Recent decades witnessed an increase in the efforts to enhance the traditional methods of teaching, including those utilized in in institutions of higher of higher education.[7, 8] The medical education has been shifted gradually from conventional teaching methodologies to the various innovative interactive learning methodologies. **Active learning enhances the higher- order thinking of the learner**. Case based learning is one of the effective interactive teaching tool.[9] **CBL is learner centric approach and helps in better understanding of the subject and also helps them to explore the real life situations**.

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The effect of implementation of CBL module as a teaching tool was assessed and analyzed by **pre- test and post- test scores** of the learners. In the present study **tables:1,2,3,4** showed the **improvement of post test scores** after the implementation of teaching learning methodology which were significantly higher and correlating with the previous studies done by Kenchiah, et al, Devi & Senthil et a.[10,11]

Table 5 showed the mean post- test scores of conventional and CBL teaching was5.68+_0.81 and 8.03+_ 1.26 respectively and **p value obtained was 0.0001** hence proved the **significant improvement of post- test scores obtained after CBL implementation in the present study** which was inconsistent the other studies done by Avishek Ganguly et al.[12] The same results had been observed in the previous studies done by Anita Singal et al, Tathe and Singh, Chamberlain et al that the learning after CBL implementation was significantly higher than conventional teaching.[6,13,14]

CBL methodology help learners to correlate prior knowledge of basic sciences with clinical cases.[15] The results of our study were in consistent with the study done by Williams et al who described utilization of CBL for collaborative learning, facilitates integration of learning, knowledge and practice.[16] In the present study while reviewing the post- test scores of conventional and CBL **in table 10 and fig2** it was observed that 84 students i.e**. 89.36% scoredmore than 60% marks** that **indicating the better correlation of basic sciences with clinical scenarios and in table9 and fig 1 revealed that 60.63% of students secured > 75% scores after** the implementation of **CBL module** which helped the learners **to improve problem solving skills** which was one of the aim of the present study and the results of present study were correlating with the previous study done by Avishek Ganguly et al.[12]

In the present study **table 8** showed **the mean post- test scores after 4 weeks of conventional and CBL module i.e. 2.47+_0.92 and 6.63+_1.38 respectively and its p value < 0.0001 which** was highly significant and indicating **the retention of the subjec**t after implementation of CBLmodule and also correlating with the previous studies done by Anita Singal et al, Ciraj et al and Chamberlain et al who observed better performance in CBL scores.[6,4,14]

While **interviewing with faculty** it has been reviewed by subject expert that **CBL module was appropriately prepared for the selected topics and implemented**. Departmental records showed that **all the faculty members were sensitized and trained** to implement the CBL module. This module was prepared for 100 students and had been implemented for 94 students. During interview with faculty it was revealed that 54.54% and 45.45% faculty strongly as well as just believed respectively that implementation of CBL would helped the students in better understanding of the subject and 72.72% and 27.27% of faculty strongly as well as just agree respectively that this interaction provided scope for increased interaction between students and teachers. The figure also revealed **that 99% of faculty agreed that CBLmethod is an effective learning tool for students**. **36.36% of faculty was of strongly opinion** that this methodology would **increase the work load for teachers** and **54.54% of faculty strongly agreed that CBL method become a part of teaching curriculum** and 9.09% of facultyhas no opinion regarding this.

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The results of present study were correlating with the study done by Poonam et al in which 40% of faculty perceived that CBL implementation is an extratask for them.(17)

On evaluating **the feedback questionnaire of students** in the present study it had been observed that **76.59% of students were strongly satisfied with case based learning module.93.61% of students and all faculty members were agreed that this module has improved the team work.**

In the present study **fig4 revealed that 75.53%, 18.08% of students strongly as well as just perceived respectively that CBL implementation helped the students to improve problem solving skills** in them and 6% has no opinion regarding this whereas in study done by Ritu Garg and Varsha Singh et al and Poonam et al showed that 73.61% students perceived that CBL methodology would increase problem solving skills in them. (17,18,19) Also the study done by Joseph A. Mayo supported that this type of learning promoted the higher level of conceptual understanding. (20)

In our study **88.29% of students** were of **opinion that this methodology promoted better retention of the subject** which was in consistent with the study done by Jasmine et al. (15)

In our study it has been revealed that **90.42% of the students believed that CBL method of learning should become a part of teaching curriculum** in Microbiology and 2.12% students disagreed with this whereas in the study done by Poonam et al 81.25% of the students agreedfor its continuity. (17)

Conclusions:

Hence it has been concluded in the present study that the **case based learning** helped in **retention of the subject** and also helps the learner in better understanding of the subject by clinical context. Clinical scenarios make it interesting and also help **in correlating the basic sciences** taught earlier. It also helped in developing **problem solving skills, analytical skills** in the learners to achieve the goal of Competency Based Medical Education that Indian Medical Graduate become a life- long learner. Although an extra work load to them, the faculty even believed that this type of learning would provide an opportunity of clinical exposure to the learners in the beginning and also agreed for the **implementation of this methodology in theteaching curriculum** so that every learner should be benefitted with this.

Implications:

It has become the **need of the hour** to introduce innovative teaching learning methodologiesto keep the **students motivated and interested.** keeping in mind the goals and aims of implementation of CBME, one such innovative method is Case Based Learning. CBL is learner centric approach and **promotes active learning with deeper conceptual understanding** of thesubject. It provides scope for increased student teacher interaction. This will help in clinical correlation of the subject and **promotes high order analytical and problem-solving skills and learner become life- long learner.** However, extra time is required for this study. **Proper planning of implementation** in the curriculum needs to be done prior hand. **More facilitators** are required for the small groups. **More workshops** required for the training of the faculty to sensitize them regarding this.

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