Original Article

DOI: 10.7860/IJARS/2018/35531:2383

Assessing the Effectiveness of Innovative Teaching in Radiology for Undergraduates using Focus Group Discussion

Radiology Section

CS SINGH, BALACHANDRA ADKOLI, KR SETHURAMAN, G EZHUMALAI

ABSTRACT

Introduction: Teaching of radiology at the undergraduate level is largely didactic and isolated from clinical context. We designed a study comparing the effectiveness of innovative teaching using Problem Solving Exercise (PSE) against conventional teaching. The present study is a part of the larger study to assess the effect of PSEs in enhancing student learning in radiology.

Aim: To assess the effectiveness of PSE in teaching radiology for undergraduates utilising Focus Group Discussion (FGD).

Materials and Methods: A full batch of MBBS students posted in the Department of Radiology during fifth semester had been taught by conventional as well as innovative method of PSE. A series of FGDs were organised in groups of 10-12 students to assess their views on the usefulness of the new method. All FGDs were voice recorded. The transcripts were analysed by two investigators to identify the emerging themes and sub themes. A method of triangulation was used to corroborate three sources of data gathered from i) The student perception on a Likert Scale; ii) Themes that emerged from FGD; and iii) Theoretical frame work of learning in order to explain the students' preference for innovative teaching.

Results: The study revealed a concurrence of data collected from perception, and comments made by students in FGDs. This in turn, could be clearly explained based on the theoretical framework of learning. The students showed high level of enthusiasm in participating in the FGD.

Conclusion: We conclude that innovative teaching using problem solving skills is not only liked by the students, but also supported by sound theoretical principles of learning, predominantly the role of feedback and reflection. FGD was found to be feasible and user friendly method for capturing student perception.

Keywords: Feedback and reflection, Interactive teaching, Problem solving exercise

INTRODUCTION

Medical education in India has been a matter of constant debate. A number of reports have been published over the last 25 years identifying the maladies in the curriculum [1-6]. The challenge is to produce an Indian Medical Graduate imbued with competencies to work effectively as a clinician, health team worker, communicator, life-long learner and a complete professional as envisioned by the Medical Council of India: Vision 2015 [7]. The absence of high quality teaching, predominance of didactic methods and lack of preparedness of faculty besides poor motivation on part of students are some of the age old maladies [8]. The teaching of Radiology is not an exception.

Radiology has made tremendous impact on patient care across the globe, thanks to the revolutionary developments in the imaging techniques. However, teaching of radiology has not caught up with this pace. A strong foundation in radiology at the undergraduate level is the need of the hour for further training [9].

Teaching of radiology at the undergraduate level varies widely across the globe, as voiced by the European Society of Radiology (ESR). In most of the countries it forms only a small part of the undergraduate curriculum, which is not being assessed adequately [10]. In the Indian context, the undergraduate curriculum is largely governed by the MCI Regulations of 1997 [11]. Radiology is assessed as a part of major subjects (Surgery, Medicine, Obstetrics and Gynaecology). The prescribed teaching hours for theory are merely 20 hours during 4th semester. The Clinical posting lasts for a period of 2 weeks of 3 hours duration during 5th semester. The teaching of radiology follows conventional lectures supplemented with postings.

In response to the need to introduce innovative method in teaching in radiology, we conducted a research study, incorporating PSE, with Picture Archiving Communication System (PACS) as a medium of teaching along with integrated teaching. This intervention resulted in the enhancement of students' knowledge and problem solving skills to a varying degree as measured by pre test/post test technique. We also studied the students' perception of the benefits of intervention using a specially designed Likert's scale [12]. The present study is an add on, to assess students' perception of this approach by utilising FGD, a qualitative method.

The main objective of our study was to assess the effectiveness of PSE in teaching radiology for undergraduates utilising FGD and to interpret the results based on the theories of learning.

MATERIALS AND METHODS

Qualitative design differs from quantitative designs in several respects. It is held in a natural setting. The present study was conducted in the Department of Radiology of a private medical college located in the Union Territory of Puducherry which admits 250 students for the MBBS course.

Since the purpose of our study was to assess students' views on the benefits of innovative method in the backdrop of our earlier findings, we chose qualitative method in preference to experimental or Quasi-experimental designs that are normally used in biomedical research [13].

While the target population consisted of students pursuing MBBS Course, the study sample included entire batch of MBBS Students (n=120) admitted during the year 2014-15, who entered 5th Semester during the study period when they were posted in small batches in the Department of Radiology. None was excluded from study as it was held in a routine schedule. The sampling framework adopted is therefore, purposive sample. The purpose was to explore students' views and opinion on the effect of PSE and the reasons behind the same.

FGD is a commonly used qualitative method which is conducted in a natural setting. It is especially convenient and useful method to explore participants' views about any intervention. Students who are often shy or hesitant to express their views individually will be willing to do so in small groups. FGD also gives opportunity to view an issue from multiple perspectives.

Ethical approval was obtained by the Institute Ethical Committee before the commencement of study.

1. From amongst the entire class of 120 students, we formed small groups consisting of 10-12 volunteers to conduct FGD. A schedule was fixed for conducting FGDs in different sittings, spread out for seven months in between February and August 2017. The participation was elicited on a voluntary basis after obtaining informed consent to record students' comments.

2. All the FGDs were conducted by the investigator in a convenient location. The investigator initiated discussion by a lead question whether they were benefitted by the PSE and if so in what manner did it help them in learning [Table/Fig-1].

3. All the FGDs were voice recorded using smart phone and the all the responses were listened and transcribed by the investigator later. The transcripts formed the basis for further analysis.

Lead Question	You have been exposed to two methods of teaching, in radiology, viz., conventional teaching and innovative teaching using Problem Solving Exercises. Out of these two methods, which one did you find to be more effective for facilitating your learning? (The students unanimously chose innovative method).
Probes	Why do you think so? Can you explain how did this method could have helped you in better learning?

[Table/Fig-1]: Lead question and probes used in FGD.

STATISTICAL ANALYSIS

The transcripts were analysed by two persons by using 'constant comparison method' which is commonly used in qualitative research. Two of the investigators went through the transcripts by using a coding system to identify the themes and sub themes that emerged out. Whenever a new item was found, they consulted each other and arrived at a consensus regarding the theme.

The essence of qualitative analysis is triangulation of data which involves combining information from three sources to establish credibility of finding. In our study we matched-a) The findings of Likert's scale showing the extent of agreement and b) The themes derived from students' comments with c) The learning theories that supported the findings.

RESULTS

The lead question and probes used by the investigator are shown [Table/Fig-1].

The Likert Scale administered to the students in our previous sub-study, consisted of 12 domains, all of which showed agreement rate ranging from 84.17% to 97.50% in favor of students preference for the innovative method [12]. The analysis of students' response [Table/Fig-2].

Agreement scores are arrived after adding the counts of 'Agree' and 'Strongly Agree' for positively worded items; In case of negatively worded items, the counts of 'Disagree' and 'Strongly Disagree' are added together. The counts in respect of 'Neutral' category are eliminated.

Total possible counts: For each item, we can expect 120 counts (including non-respondents). If there are 2 items, relating to an attribute, the counts expected are 240.

The comments made by the students in the FGD fell under

S. no	Attribute of Problem Solving Exercise	Total possible counts*	Agreement counts n (%)	Disagreement counts n (%)
1	Team work	120	117 (97.50)	0 (0.00)
2	Facilitating commu-nication	240	229 (95.42)	2 (0.83)
3	Use of multiple strategies	120	114 (95.00)	4 (3.33)
4	Motivation for learning	240	225 (93.75)	2 (0.83)
5	Application for clinical setting	360	336 (93.33)	0 (0.00)
6	Meaningful learning	120	111 (92.50)	9 (7.50)
7	Teacher attitude	360	333 (92.50)	11 (3.05)
8	Linking information with previous experiences	120	110 (91.67)	0 (0.00)
9	High interactivity	360	325 (90.28)	12 (3.33)
10	Increase in reasoning skills	360	324 (90.00)	18 (5.00)
11	Overall Satisfaction	480	424 (88.33)	20 (4.17)
12	Integrated teaching	120	101 (84.17)	4 (3.33)

[Table/Fig-2]: Table showing total possible rating scores and agreement or disagreement scores against each attribute of the problem solving exercise referred in Likert scale (n=120).

seven themes, which are shown in [Table/Fig-3].

The attributes most liked by the students as per the findings from Likert scale, themes emerged from FGD were further linked with the theoretical frame work of learning and depicted in [Table/Fig-4]. It can be seen that there is a convergence of all three sources.

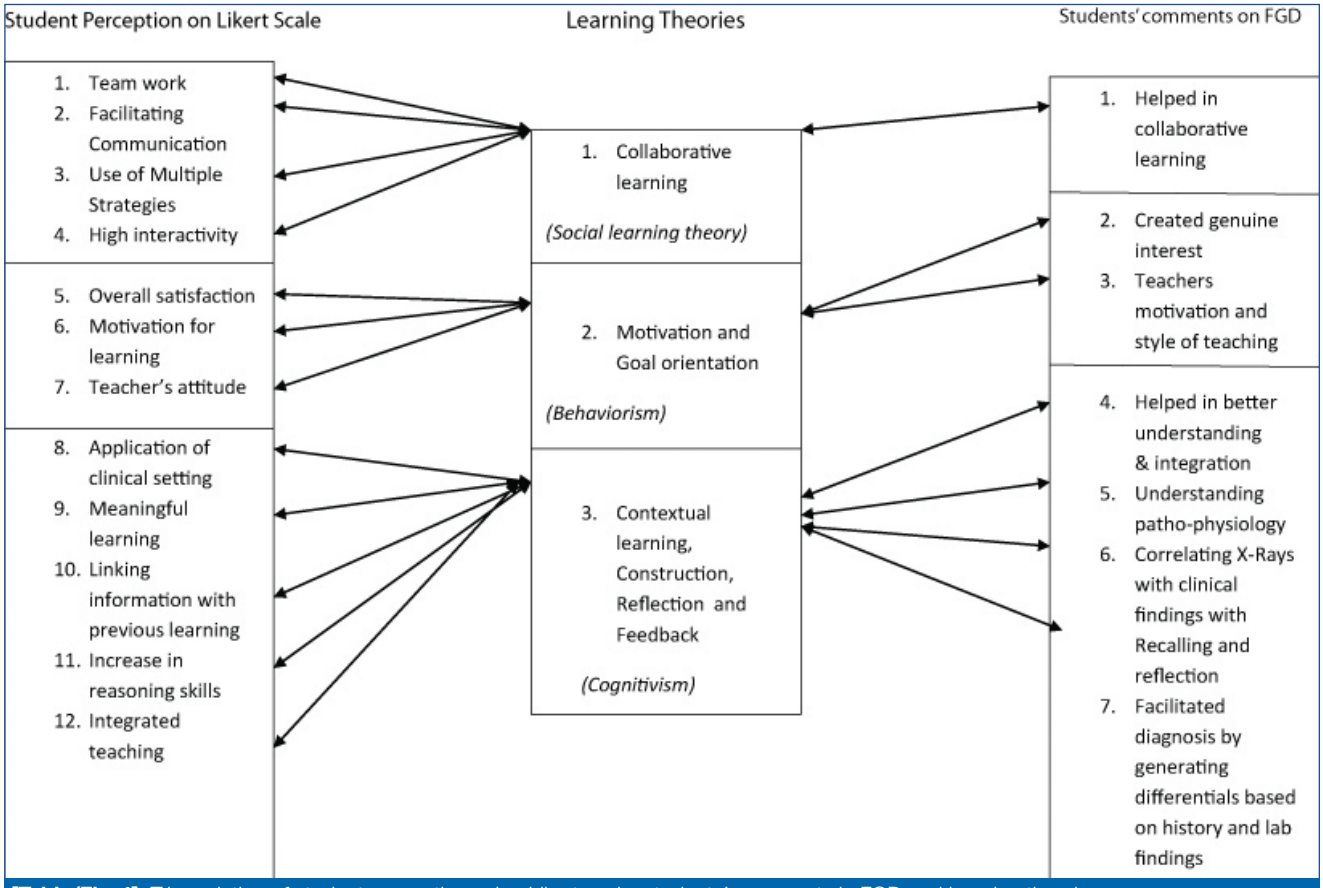
1.The students' positive perception regarding team work, facilitating communication, use of multiple strategies and high interactivity were in concurrence with their comment made in FGD that it was 'collaborative learning' which was responsible for their effective learning. This is backed by the 'social learning theory' which is one of the major schools of learning. This also embeds principles like, engagement in the group task, team work, and active participation of the whole class.

2.During FGD, students made comments such as the teacher 'created genuine interest' and they liked 'motivation provide by the teacher and his style of teaching'. The learning theories drawn from 'behaviorism' emphasise the role of teacher in proving constant reinforcement of students' efforts in the classroom.

S. no	Students' Comments (Quotes) in the FGD	Themes emerged
1.	It (viz., Problem Solving Exercise) made us discuss with colleagues. This way it help us to communicate better. The case discussion was easy in this method by team work.	It (Problem Solving Exercise) helped in collaborative learning
2.	Though radiology is not the exam subject, I am not de-motivated. By applying the knowledge gained in radiology, I will be able to ask for the suitable investigation, before coming to diagnosis.	PSE created genuine interest
3.	This type of class taking was good. It is more practical and realistic. We enjoyed the class. Teaching was done in a step by step method, for example, in an abdominal X-ray, how to identify the normal bowel. how to look for a distended bowel, was very nicely explained. This way we understand better.	The motivation provided by the teacher and style of teaching helped in better learning.
4.	Multiple x-rays were shown both of normal one and abnormal one. Discussion was two way, between the professor, and the student. We understood better also through interaction (integration) with subject specialist.	PSE helped in better understanding and integration
5.	Understanding of the pathophysiology of a case was made easy by this method. Number of X-rays that were shown about the disease made us to get proper insight into pathophysiology.	PSE was helpful in understanding patho-physiology
6.	We could correlate X-rays with findings. For example, hepatomegaly was taught in medicine, but the X-ray was not shown. Here when the hepatomegaly X-ray was shown, suddenly in my mind the thought of the clinical posting came. I became happy.	PSE helped in correlating X-Rays with clinical findings (recall and reflection)
7.	PSE was useful in proper diagnosis of the cases. This helped us to easily get an overall view of the signs and symptoms of a disease and we were able to come to a conclusion regarding differential diagnosis.	PSE Facilitated diagnosis by generating differentials based on history and lab findings on history and lab findings

[Table/Fig-3]: Students' comments made in the FGD and the themes emerged.
*PSE-Problem Solving Exercise

3.The students' perception via Likert's scale showed preference for attributes such as application of clinical setting, meaningful learning, linking information with previous learning, increase in reasoning skills, and integrated teaching. This was



[Table/Fig-4]: Triangulation of student perception using Likert scale, students' comments in FGD and learning theories.

re-confirmed by their comments such as PSE 'helped in better understanding and integration', 'helped in understanding pathophysiology', 'helped in correlating X-rays with clinical findings by recalling and reflection' and 'facilitated diagnosis by generating differentials based on history and lab findings'. These can be linked with learning principles derived from cognitive school of learning which emphasises contextual learning, knowledge construction, and role of reflection and feedback in enhancing meaningful learning.

Thus, our analysis reveals two things. It shows that the intervention, viz., PSE really helped the students to enhance their learning in radiology. It also leads us to conclude that the students' comments made in the FGD are not biased, but based on the sound principles of learning.

DISCUSSION

Our findings address two issues, viz., the efficacy of the intervention in terms of enhancement of student learning and the utility of the FGD as a method to support earlier findings of quantitative data.

The reasons behind the success of intervention perhaps lie in the educational theories propounded by educators from time to time [14,15]. Malcolm Knowles, who introduced the term "Andragogy" strongly, believed that adult learners are essentially self directed learners. He derived seven principles of learning which deal with i) Establishing a safe and enjoyable learning environment; ii) Involving the students in the planning process; iii) Involving them in diagnosing their own learning needs, so that they become deeply interested; iv) Helping them establish their own learning goals; v) Making them to design their own strategies of learning; vi) Extending support to the learners in their journey; and vii) Making them evaluate their own learning by process of reflection [16]. It can be inferred that PSE has a potentiality to encourage self directed learning.

PSE is tool for stimulating reflection. Reflection and reflective practice appear to be the new mantra for facilitating learning. The six principles emphasised by Brookfield SD, also include reflection as a major element [17]. In terms of Experiential learning theory propounded by Kolb DA, reflective observation is one of the major elements in the process of learning [18]. Schon DA, work on reflective practice, what is called 'zones of mastery' makes a distinction between 'reflection in learning' (reflecting as you learn) and 'reflection on learning' (reflecting after the event is over) [19]. A third element 'reflection for learning' has also been discussed, along-with the recommendation that reflective techniques

and practices should be incorporated in all phases of medical education [20]. The reflective experience described by the students in our study mainly falls under 'reflection on learning'. The students frankly came out with their comments on how they were helped by this process of reflection facilitated by the teacher after their clinical experience of posting in the wards. However, not withstanding the comments made by the students, our observation reveals that many of the students were not really reflective enough to consider the 'case as a whole'. Another major factor which might have influenced students' preference for the innovative method appears to be role of feedback provided to the students by showing the radiological findings and presenting variations of X-rays and other images to reinforce their learning.

While feedback and reflections have their own role to play in enhancing learning, it becomes reasonable to assume that they collectively play a major role. This has been substantiated in several studies that have considered these issues together in improving student performance.

Devi V et al., investigated the role of structured feedback on the examination performance combined with the opportunities for self-reflection in the form of 'reflection in learning'. The students' perceptions were highly positive in favour of feedback, which helped them in improving their examination performance [21]. A report from Taiwan by Wen CC et al., also suggests that structured narrative reflective writing when combined with group discussions with a tutor and peers facilitates much deeper reflection [22]. Extensive literature is now available on the role of feedback, various models and techniques of feedback, and tips for giving as well as receiving feedback [23-26]. However, what is not yet clear is the characteristic of written or verbal feedback that can really stimulate students' reflective competence.

Gonzalo JD et al., conducted a qualitative analysis of interview scripts of bedside clinicians (n=34), to explore the timing and manner of manner of giving feedback [27]. The clinicians gave positive feedback during the clinical encounter, team-based feedback immediately following the encounter and individualised constructive feedback on one-on-one setting following the rounds. In our study, the feedback was given in a class room set up and it was mostly positive.

It should be acknowledged that reflective ability is being considered as a core competency in the backdrop of Competency Based Medical Education (CBME) [28]. Writing narratives, listening to audio recordings, digital storytelling, informal chat with friendly critiques, can all be tried to stimulate reflective competence. The maintenance of portfolio or e-portfolio by the student followed by interaction with the mentor can be a very effective method especially for promoting competency based postgraduate medical education [29]. How to develop feedback skills among teachers and reflective skills among students is a fertile soil for further research. This also calls for the role of faculty development. In the Indian context, Faculty Development Programs have started using feedback and talking about feedback, including the need to obtain Multi Source Feedback (MSF) which is a healthy development.

The second agenda of our study to utilize FGD as a method of capturing students' perception was pursued with a large success and a new insight. To the best of our knowledge the use of FGD is of rare occurrence in radiology teaching and research in our context. Even educational research itself is in its infancy in health profession education as reported by one of the authors pleading for more efforts in this direction [30]. However, our experience reveals that the study subjects are highly enthusiastic in participating in the FGD sessions.

LIMITATION

Our study has some limitations. Since, the intervention was conducted by the investigator who taught the students, the desirability bias cannot be ruled out. There is likelihood of some errors creeping in coding and interpretation of the students' response. The generalisability of our findings to a larger population of medical colleges in India is also doubtful. There is also a lack of 'culture of feedback' in the Indian context, which might have inhibited the students from giving honest and frank views. We therefore recommend that more research efforts and multi centric studies are needed to verify our findings in support of innovative teaching methods like PSE. There is also a need develop these skills right from UG training to in-service training of faculty. Faculty development plays crucial role in this task. The teaching should be brought to a higher level of scholarship which should be linked with career enhancement and recognition.

CONCLUSION

Our experience reveals that innovative teaching in the form of PSE, combined with continuous feedback and positive reinforcement can play a key role in enhancing student performance as well as student satisfaction in radiology teaching at the undergraduate level. In order to capture student experience, FGD is a feasible and effective way forward. With the current interest generated among the teachers to explore new pathways of training and research, we can expect a bright future for innovating teaching, tools and techniques in medical education contributing to better patient care.

ACKNOWLEDGEMENTS

The study is a part of Doctoral work of the first author.

REFERENCES

[1] Kacker SK, Adkoli BV. Need-based undergraduate medical curriculum. Indian J Pediatr. 1993;60:751-57.

[2] Sood R, Adkoli BV. Editorial medical education in india-problems and prospects. J Ind Acad of Clin Med. 2000;1:210-12.
[3] Supe A, Burdick WP. Challenges and issues in medical education. Acad Med. 2006;81:1076-80.
[4] Sood R. Medical Education in India. Med Teach. 2008;30(6):585-91.
[5] Ananthakrishnan N. Medical Education in India: Is it still possible to reverse the downhill trend? Natl Med J India. 2010;23(3):156-60.
[6] Jayakrishnan T1, Honhar M, Jolly GP, Abraham J, T J. Medical Education in India: time to make some changes. Natl Med J India. 2012;25(3):164-67.
[7] Medical Council of India: Vision 2015. 2011. [Available at]: https://old.mciindia.org/tools/announcement/MCI_booklet.pdf
[8] Chacko TV. Improving quality of medical education in India: The need to value and recognize academic scholarship. J Pharmacol Pharmacother. 2013;4(3):171-73.
[9] Bhogal P, Booth TC, Phillips AJ, Golding SJ. Radiology in the undergraduate medical curriculum-Who, how, what, when, and where? Clin Radiol. 2012;67(12):1146-52.
[10] European Society of Radiology (ESR). Undergraduate education in radiology. A white paper by the European society of Radiology. Insights Imaging. 2011;2(4):363-74.
[11] Medical Council of India Regulations on Graduate Medical Education, 1997; [Available at]: https://www.mciindia.org/documents/rulesAndRegulations/GME_REGULATIONS.pdf
[12] Singh S. Adkoli BV, Sethuraman KR, Ehzumalai G. Students' perception of problem solving exercise in radiology education for undergraduates. EPJMR. 2017;4(02):631-38.
[13] Adkoli BV, Al-Umran KU, Al-Sheikh M, Deepak KK, Al-Rubaish AM. Medical students' perception of professionalism: A qualitative study from Saudi Arabia Med Teach. 2011;33(10):840-45.
[14] Kaufman DM, Mann KV. Teaching and learning in medical education: how theory can inform practice In: Understanding Medical Education Evidence, theory and practice. Ed. Tim Swanwick Wiley-Blackwell (ASME). 2010.
[15] Kaufman DM. Applying educational theory in practice. BMJ. 2003;326(7382):213-16.
[16] Knowles MS and Associates. Andragogy in action: applying modern principles of adult learning. San Francisco: Jossey Bass.1984.
[17] Brookfield SD. Understanding and Facilitating Adult Learning. Milton Keynes: Open University Press.1986.
[18] Kolb DA. Experiential Learning; experience as the source of learning and development. Prentice Hall, Englewood Cliffs, NJ, 1984.
[19] Schon DA. Educating the reflective practitioner: toward a new design for teaching and learning in the professions. San Francisco: Jossey Bass, 1987.
[20] Srivastava TK, Waghmare LS, Mishra VP. Reflections: An approach to comprehensive learning in medical education. National Journal of Physiology, Pharmacy and Pharmacology. 2015;5(2):153-56.
[21] Devi V, Mandal T, Kodidela S, Pallath V. Integrating students' reflection-in-learning and examination performance as a method for providing educational feedback. J Postgrad Med. 2012;58(4):270-74.
[22] Wen CC, Lin MJ, Lin CW, Chu SY. Exploratory study of the characteristics of feedback in the reflective dialogue group given to medical students in a clinical clerkship. Med Educ Online. 2015;20:25965.
[23] Anshu. Effective Feedback in Medical Education. In: Bhuiyan PS. Rege NN, Supe A. (eds.) The Art of Teaching Medical Students 3rd ed. New Delhi: Elsevier. 2015. Pp:248-60.
[24] Cantillon P, Sargeant J. Giving feedback in clinical settings. BMJ. 2008;337:a1961.
[25] Krackov SK. Giving Feedback. In: Dent JA & Harden, RM (Eds) A Practical Guide for Medical Teachers (3rd Ed), Churchill Living Stone, Elsevier, 2009.
[26] Ende J. Feedback in clinical medical education. JAMA. 1983;250(6):777-81.
[27] Gonzalo JD, Heist BS, Duffy BL, Dyrbye L, Fagan MJ, Ferenchick G, et al. Content and timing of feedback and reflection: a multi-center qualitative study of experienced bedside teachers. BMC Medical Education 2014; 14:212
[28] Epstein RM, Hundert EM. Defining and assessing professional competence. JAMA. 2002;287(2):226-35.
[29] Ananthakrishnan N, Karthikeyan P, Jaganmohan R, Pulimoottil DT, Ravishaker M, Adkoli BV, et al. SBV Model of Competency Based Learning and Training (COBALT) for post graduate education. Annals of SBV. 2017;6(1):5-9.
[30] Adkoli B.V. Educational Research in Health Sciences. Journal of Education Technology in Health Sciences. 2017;4(2): 38-41.

AUTHOR(S):
1. Dr. CS Singh
2. Dr. Balachandra Adkoli
3. Dr. KR Sethuraman
4. Dr. G Ezhumalai

PARTICULARS OF CONTRIBUTORS:
1. PhD Scholar, Department of CHPE Centre for Health Professions Education Sri Balaji Vidyapeeth (Deemed University), Puducherry, India.
2. Director, Department of Centre for Health Professions (CHPE), Centre for Health Professions Education Sri Balaji Vidyapeeth (Deemed University), Puducherry, India.
3. Vice Chancellor, Senior Faculty, Department of Centre for Health Professions Education, Sri Balaji Vidyapeeth Deemed University, Puducherry, India.
4. Senior Statistician, Sri Balaji Vidyapeeth Deemed, University, Puducherry, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Balachandra Adkoli,
Mahatma Gandhi Medical College and Research Institute
Pillaiyarkuppam Puducherry, India.
E-mail: bvadkoli@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Publishing: **Apr 01, 2018**