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Effect of a 'Flipping' the Classroom Teaching in Anesthesiology Residents.

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Abstract:
Background: *Conventional teaching methods that included seminars and lectures, led to one sided monotony among residents, resulteingin teaching sessions being a forced agenda rather than an interactive session. The need to do some thing out of the box to promote learning amongst post graduate students in anaesthesiology, led to us flipping the classroom approach, where learners view educational content prior to class and engage in active learning during didactic sessions.*
Objective *: We hypothesized that a flipped classroom improves knowledge acquisition and retention for residents compared to traditional lecture, and that residents prefer this approach.*
Methods : *The study was conducted in 2019.The same group of 16 post graduate students were exposed to both conventional teaching methods going on in the department and also to the flipped classroom. The flipped classroom consisted of reviewing a 10-minute video, followed by 45-minute in-class interactive sessions with audience response questions, think-pair-share questions, and case discussions. The traditional lecture approach consisted of a 50-minute lecture given by faculty or a resident with 5 minutes for questions. Residents completed 2 knowledge tests (pretest and posttest),and surveys of their perceptions of the didactic sessions. A linear mixed model was used to compare the effect of both formats on knowledge acquisition and retention.*
Results : *Of 16 eligible postgraduate anesthesiology residents, 14 participated in the entire intervention, and 13 completed all tests. The flipped classroom approach improved knowledge retention at the post test. (adjusted mean = 6%; P = .014; d = 0.56), and residents preferred the flipped classroom (pre = 46%; post = 82%; P < .001).*
Conclusions : *The flipped classroom approach to didactic education resulted in a improvement in knowledge retention and was preferred by anesthesiology residents.*

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I. Introduction

Post graduate education in anaesthesiology remains a challenge. A dependent branch like anaesthesiology where residents don't have a dedicated scheduled time for learning activities, leads to the resident being mostly tired or uninterested for a postgraduate activity, consisting of a didactic lecture or a seminar. Didactic sessions have traditionally been provided in lecture format. The flipped classroom approach reverses this traditional method, with learners completing preclassroom "homework," and classroom time is used for interactive learning and problem solving. A goal of the flipped classroom is to depart from a passive, teacher-centered approach in favor of learner-centered active learning.[1],[2]

Empirical studies of the flipped classroom in other health professions education have found beneficial effects,[3],[4] including knowledge gain.[5],[6] Supporting evidence in medical education is scarce, and most studies involved medical students.[7] There remain very few published data of the effect of flipped classrooms in a speciality like anaesthesiology.

We examined the flipped classroom in anesthesiology residents at our department. We hypothesized that it would result in improved knowledge acquisition and retention, compared to traditional lectures, and that learners would prefer the flipped classroom.

Methods

Setting and Participants

Participants consisted of 16 postgraduate anaesthesiaresidents , all of them enrolled for M.D Anaesthesiology course in our department affiliated to MUHS Nashik.

Design

This was a prospective, controlled, educational research study. Educational content was delivered for each teaching method (flipped classroom or traditional lecture) in 4 consecutive weekly sessions over 6 months. A pretest was administered before the intervention, a posttest immediately following the intervention.

Invited to participate = 16
Consented and participated = 14
Withdrawn =2
Participated in the Entire Session = 14
Post test n=14

Educators developed the educational sessions. To maintain consistency among content, the same educator developed all materials (flipped classroom and traditional lecture) for a given topic. Materials were peer-reviewed by all educators participating in the study. The materials and test questions covered the anesthesia-specific syllabus prescribed by the governing university.

One educator facilitated all educational sessions. He reviewed a podcast, explained the flipped classroom concept, reviewed the educational materials, and discussed content with the participants.

Traditional lectures consisted of 55-minute lectures utilizing PowerPoint (Microsoft Corp, Redmond, WA), followed by 5 minutes for resident questions. Notes were provided for consistency of delivery. For flipped classroom sessions, a 15-minute video was created as a preclassvideocastconsisting of PowerPoint slides with voiceover narrative covering foundational information on the topic. We utilized videos for the prework, as it is believed that the new generation of learners prefers this to reading assignments[8]. Flipped classroom learners were asked to preview the videos before the 45-minute in-class sessions. Flipped classroom time was interactive, with educators utilizing audience response questions, think-pair-share questions, and case discussions. To standardize these sessions, slide-based presentations were provided that contained questions in these active learning formats. Video assignments (flipped classroom only) and reading recommendations (both groups) were made available through a learning management system.

Educational sessions were delivered over the same 6-month period.Pretest was given. Immediately following each educational session, residents received a survey inquiring about their session attendance, video reviewing (flipped classroom only), and amount of time spent reading. At the end of the intervention, residents received the posttest and a survey inquiring about their perceptions of the teaching methods.

Outcomes

A 40-item multiple-choice test was developed to measure the knowledge acquisition (posttest). Design and assessment of test questions involved a modified Delphi technique,[9]with question writing and review by 2 expert anesthesiologist educators to promote content validity. Questions were piloted with 4 residents who did not participate in the study. The questions were psychometrically assessed using Rasch analysis and modified as necessary for final use.[10] To examine residents' attitudes toward the flipped classroom versus traditional lectures, the authors developed a survey, which was pilot tested and underwent slight modifications.
Thestudy was reviewed by its Institutional Review Board and declared exempt.

Statistical Analysis

Primary outcome measures were residents' knowledge acquisition and retention as measured by percentage of correct answers on the posttest. Linear mixed model was used to assess statistical significance of the effect of each teaching method and time (repeated tests) on knowledge acquisition. The statistical model included teaching method, time, and interactions as independent variables. The correlated nature of error terms due to repeated assessments within each study participant was modelled using an unstructured covariance matrix.

Secondary outcome measures were resident attitudes toward the flipped classroom, and these surveys were filled out by the residents who experienced this approach. The McNemar-Bowker test was used to track residents' preference. Group comparison on demographics that did not involve repeated measures used an independent t test ora chi-square test (ie, sex, flipped classroom experience). A P value of .05 or less was considered statistically significant. All statistical analyses were completed using SPSS version 4.0.

Given the sample of 14 residents ($n = 14$ for flipped classroom, $n = 14$ for traditional lecture) for knowledge acquisition and retention analysis, the effect size of the flipped classroom relative to the traditional lecture should be of value greater than $d = 0.50$ with probability (power) 0.90 in order to determine a statistical significance at the .05 level.

II. Results

Of 16 eligible residents 14 (87%) consented to participate, 14 (85%) participated in the entire intervention, and 14 (87%; $n = 14$ for flipped classroom; $n = 14$ for traditional lecture) completed all knowledge

tests. The flipped classroom group (n = 14) also completed both pretest and posttest surveys of their perceptions of this learning model.

There was no group difference in preclass reading time (P = .10;). 88% flipped classroom residents watched at least 75% of the assigned videos prior to class. Two flipped classroom and 3 traditional lecture residents had missing values on some covariates; their data were deleted from the analysis for effect size estimation. The pretest percentage correct was higher for the traditional lecture than for the flipped classroom.

Knowledge Acquisition and Retention

After statistically adjusting for the difference in pretest performance and other control variables in the mixed effects model, the between-group difference on pretest percentage correct was no longer significant (flipped classroom adjusted mean = 61%; traditional lecture adjusted mean = 63%; P = .95). Mixed effects modeling revealed significant interaction (P = .003) between teaching method (flipped classroom and traditional lecture) and time (posttest and retention test), controlling for covariates. As depicted in the effect of the teaching method appears to vary by time. The flipped classroom did not show a difference in knowledge acquisition (posttest adjusted mean = 5%; P = .06; d = 0.48), but demonstrated improved knowledge retention, compared to traditional lecture (retention adjusted mean = 6%; P = .014; d = 0.56).

Attitudes Toward Flipped Classroom

McNemar-Bowker tests revealed a preference for the flipped classroom (pre = 46%; post = 82%; P < .0001).

III. Discussion

In a country like India it is very difficult for anaesthetists to modify a current method of teaching which has been in existence since long.This is the firstsuch report of a prospective trial in a residency setting in India comparing the effects of the flipped classroom to a traditional lecture format, with regard to knowledge change and learner preference. While we did not find a difference in knowledge acquisition between the 2 methods, the flipped classroom improved knowledge retention. (d = 0.56), compared to the traditional lecture, demonstrating a modest beneficial effect. The residents who experienced the flipped classroom demonstrated a strong preference to this method. The higher knowledge score post test in the flipped classroom group may have been related to its engaging nature that led to enhancement of triggers during the clinical learning of similar topics thus amplifying the knowledge gained in the intervention.

A recent review found a small effect (median d = 0.08) of the flipped classroom on knowledge and skill in medical students.[7] The flipped classroom may be a useful teaching method in graduate medical education, with its competing demands on learner time and improvement in remote access to content[11].

Similar to medical students[12], residents preferred the flipped classroom. The postintervention survey suggested that residents found the flexibility of watching prerecorded lectures on their own time helpful, believed they would retain more information, and felt the flipped classroom better prepared them for board examinations and clinical practice.

One criticism of determining the utility of the flipped classroom literature is the difficulty to assess if learners are compliant with preclass assignments. Our residents were compliant with a rate of 88%. Factors that may have contributed to our high compliance rate include the fact that participants were volunteers and the curriculum prepared them for a high-stakes examination. However, Heitzet al[13] found a one-third noncompliance rate in their learners.

Our study has a few limitations. We assessed the flipped classroom in a single specialty and with limited educational topics, making it difficult to generalize the findings to other specialties and topics. Additionally, we solely utilized multiple-choice questions for knowledge assessment. A more profound effect in knowledge gain might be demonstrated through testing involving higher-order thinking such as case analysis, simulations, and workplace-based assessment.

Future research should investigate whether the positive effect of the flipped classroom can be replicated in other specialties and explore why learning appears to continue following the flipped classroom method of teaching.

IV. Conclusion

Our findings revealedthat anesthesiology residents' recommended preference for the flipped classroom and a beneficial effect of this teaching method on knowledge retention.

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