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Team-Based Learning in Medical Universities: Infrastructure and Requirements

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Context: This review study, performed in 2014, sought to determine the requirements for the introduction of team-based learning (TBL) in medical universities.

Evidence Acquisition: In this review study, relevant literature was found by searching PubMed, MEDLINE, Google Scholar, ScienceDirect, and ProQuest using the keywords of team based learning, facilitate, barrier, and challenge without any time limitation. First, the literature was selected after a review of the abstracts. Subsequently, according to the relevance to the study questions, 12 articles were included in the analysis.

Results: Overall, it is essential that educational administrators fully consider the prerequisites of TBL implementation in 2 areas of pre-implementation infrastructure and execution. This goal can be attained through the establishment of 4 underlying substrates of management, planning, facilities and financial and human resources. Requirements during the implementation of TBL encompass orientation phase, process elements, and human resources skills. Fulfilling these requirements can generate positive attitude and support amongst administrators, faculty members, and students and bolster the chance of the success of plans to move the curriculum of medical universities to a more TBL-oriented approach.

Conclusions: Meeting the prerequisites to incorporating TBL in the curriculum of medical universities plays a pivotal role in its success. Accordingly, in the assessment of the curriculum of medical universities, these requirements should be fully identified and fulfilled so as to be able to devise appropriate plans for the success of teaching methods.

Keywords: Cooperative Learning; Team Based Learning; Interactive Learning; Academic Medical Centers; Healthcare Team

1. Context

In recent decades, there has been a shift of emphasis in medical education curricula from a teacher-centered approach to an integrated and learner-centered approach. The first step to the method is to decrease reliance on non-active teaching methods such as lectures and then move toward active methods such as small group activities, team-based learning (TBL), and problem-based learning (1). Since its introduction in 1970, TBL, a collaborative learning method applied in various learning environments, has been one of the most noteworthy methods amongst student-centered approaches (2). This method was originally developed by Michaelsen and gradually gained popularity thanks to its efficacy in medical education (3). The TBL method is a new strategy that meets students' needs in accordance with pedagogical principles through concentration on knowledge application in a cooperative environment. This approach confers an appropriate platform for the achievement of knowledge in higher education. The objective is to attain goals that are loftier than merely knowledge acquisition through the provision of opportunities for in-depth learning, problem-solving skills, and teamwork cooperation (3-5). Moreover, students are encouraged to develop self-directed learning skills before and during TBL sessions through active participation in small groups with a view to enjoying a deeply gratifying learning experience. Thus, TBL can help master teaching content, hone self-directed learning and problem-solving skills, and encourage critical thinking (3, 6-15). The range of the application of this approach encompasses basic sciences (10, 16, 17), internship (18, 19), residency (20), and medical continuing education (1, 21).

Given the ever-increasing recognition of TBL in medical education across the globe and the need for a revision of the medical science curriculum in Iran, we sought to determine the application requirements of this approach in 2 areas: pre-implementation infrastructure and execution.

2. Evidence Acquisition

In this review study, relevant papers were found by searching PubMed, MEDLINE, Google Scholar, ScienceDirect, and ProQuest using the keywords of team based learning, facilitate, barrier, and challenge without time limitation. There is a paucity of data in the existing literature on requirements for the implementation of TBL. Overall, 71 articles were found. Of this total, 23 articles pertinent to the research objectives were identified. The abstracts of these papers were reviewed, and ultimately 19 full-text relevant articles were included for analysis. The current study presents a classification of the results of our literature review and discusses TBL in terms of its implementation requirements, process, facilitators, and barriers.

2.1. Necessary Infrastructure Requirements Before Implementing Team-Based Learning

Moving toward a student-centered approach requires basic factors such as management system and human/financial/physical resources. One of the basic points in the implementation of TBL is that if the target is to provide a part of the curriculum through TBL, it is vitally important that faculty members be the first to be oriented to this method (22). Indeed, the introduction of this method in university requires instructors eager to employ new teaching methodologies alongside learners enjoying novel approaches (14). It has been suggested that if there is a limitation on time or resources, running 1 or 2 TBL sessions in the curriculum could have favorable effects (23). Altering pedagogical methods is, however, a time-consuming, challenging process and cannot be effected instantaneously (14). Accordingly, plans for the implementation of TBL should include training faculty members and developing training materials, which requires expertise and a great deal of time and effort (14). This is where management support comes to the fore insofar as the requirements for appropriate policies based on needs assessment and analysis of the current status of the university constitute the cornerstone of success in this endeavor. It is, therefore, advisable that universities refrain from a drastic departure from the traditional methods and in order to reform teaching method, they need to identify current status and requirements to make proper decision and take the best action Thompson divided the implementation requirements of TBL into 4 components: expertise, resources, time, and course features, and emphasized that all these factors could positively or negatively affect the performance of TBL (24).

In this paper, we discuss the infrastructure requirements to the implementation of TBL in universities of medical sciences. The results are divided into 3 major categories: space and time resources, human resources and the development thereof, and planning and management.

3. Results

Necessary infrastructure requirements before implementing team-based leaning (TBL) in terms of space and time resources (14, 24), human resources and development thereof (14, 22, 23), and planning and management (5, 14, 22, 23) are presented in Box 1.

3.1. Requirements for the Implementation of Team-Based Learning

After providing the infrastructure for TBL, it is essential to review and examine the requirements and necessary skills to implement this method. In Thompson's study on TBL implementation, it was concluded that it is mandatory to offer individual support to faculty members for managing the sessions and to furnish appropriate facilities and equipment (e.g., audience response system) (24). Another study determined the requirements for the implementation of TBL as providing orientation sessions for students and creating individual and team motivation to increase student participation in TBL sessions (14). In the present study, TBL requirements are divided into 3 components: learner orientation phase, process elements, and human resources skills.

3.2. Requirements for the Implementation of Team-Based Learning: Learner Orientation Phase:

This phase consists of holding orientation sessions before starting the module in order to enhance the students' enthusiasm toward this method; providing the learners with instructions about TBL, its advantages, and evaluation via sending them an email 3 weeks before starting the course; holding orientation sessions 2 weeks prior to a TBL session; setting goals and expectations for the teachers with respect to preparing the students; and underscoring TBL benefits in the orientation sessions and highlighting the importance of group readiness assurance test (gRAT) scores over individual readiness assurance test (iRAT) scores (14, 23).

3.3. Requirements for the Implementation of Team-Based Learning: Process Elements:

This component comprises the provision of a blueprint concerning the objectives as well as the required materials for the pre-reading assignments and the preparation tests and answers thereof (14).

3.4. Pre-Reading Sessions

These sessions seek the objectives of allowing the teachers, rather than the students, to make decisions about the content of the study; sending weakly reminder e-mails to the students on the pre-reading resources; allocating the necessary time for preparing the students; dealing with the new content before the team debate; considering the volume of the required material for the pre-reading as-

signment and the time required to accomplish the task; and demanding that the pre-reading assignment be done before the team debate (14, 25).

Box 1. Necessary Infrastructure Requirements Before Implementing Team-Based Leaning (TBL)

Infrastructure Requirements
Space and Time Resources
Space resources
□ Providing space as an important resource
□ Providing classrooms with adequate space for TBL
□ Developing a bank for test preparation and group assignments
□ Providing books and materials for independent study
□ Providing large classrooms with proper sitting arrangement
□ Providing audio system for appropriate interaction
Time resources
□ Allocating sufficient time before commencing the sessions and material codification for TBL (test preparation and group assignment)
□ Observing the time allocation
Human Resources and Development
□ Developing appropriate cultural organization
□ Creating powerful leadership and management
□ Receiving support from the educational system authorities for implementing TBL
□ Developing expertise amongst the teachers
□ Determining the course benefits to gain support from the teachers
□ Creating enthusiasm and interest as regards the new teaching methods
□ Building trust in the faculty members toward TBL
□ Using experimental techniques in teacher training courses
□ Providing necessary skills to manage teacher training courses
□ Mentoring and guiding new teachers by other TBL-experienced teachers
□ Gaining necessary personal experience before commencing formal courses
□ Providing the teachers with comprehensive training on how to provide effective feedback to their partners (if there is a plan to assess counterparts)
□ Forging acceptance and support on the part of the teachers, students, and administrators
Planning and Management
□ Avoiding the underestimation of efforts required to change lecture-based training into TBL
□ Professional counseling regarding TBL
□ Guaranteeing the staff's commitment to the implementation of the new teaching methods
□ Garnering the support of the university development center
□ Detailed planning for training the teachers throughout the implementation process
□ Encouraging the teachers to attend annual TBL collaborative meetings in order to gain further practical experience
□ Providing specialized training for the faculty members
□ Obtaining the acceptance and support of the students by engaging them in the process of selecting teaching methods
□ Encouraging the students' participation in developing peer assessment and peer feedback
□ Planning and supporting material development for formulation, implementation, and evaluation modules
□ Using new methods in integrated sessions
□ Establishing a balance between local needs in each university

The basic elements of TBL are as follows (22): focusing on the goal; communicating and negotiating; identifying the outcome; selecting the team members meticulously and paying heed to the size and stability of the team; clarifying the method of team creation; creating a management team composed of teachers not students; including between 4 and 7 members in the team; keeping each of the team members throughout the course; preventing poor performance by the team members as a result of nonattendance, rifts within the group, and refusal to learn collectively; emphasizing the significance of punctuality and time saving and checking the learners' attendance at the beginning of the session (14); ensuring readiness; covering effective and efficient content; organizing the team and augmenting teamwork skills; encouraging learning from data derived from different sources; developing lifelong learning skills and self-directed learning; and encouraging proper usage of time.

3.5. Test Preparation Process

This process aims at determining the number of questions based on content (between 5 and 15 multiple-choice questions); scheduling for the test (1 minute per question); taking heed of the admission process for the preparation of pretest questions; administrating the test individually and collectively to assess prior knowledge and understanding of the duties; using a checklist to assess the questions before a TBL session (2, 14, 22, 25); receiving immediate feedback; considering the mechanism of providing feedback at each session; attaching significance to feedback during individual evaluations, group discussions, and team assignments; adopting appropriate feedback during test preparation (including theimmediate feedback assessment technique [IF-AT] form or electronic audience response systems); providing immediate feedback during teamwork activities in order to facilitate team discussion (14); providing feedback by the teachers so as to confirm or correct the proceedings during the group tests and team debates and after teamwork (25); sequencing problem solving; considering the sequence of iRAT, gRAT, and group assignments; discussing the tests and group assignments; assigning iRAT and gRAT during the class and not before it; implementing peer evaluation; organizing peer evaluation and feedback; requiring adequate training of the students as regards structural assessment; implementing formative assessment or team process analysis; developing a multiple choice questionnaire with 3 - 5 questions for peer assessment; identifying desirable goals for peer assessment; creating a peer assessment process in accordance with the learning objectives; considering quantitative and qualitative evaluations (14); incentivizing; determining the exact scale score and rubric for the students and explaining it in the first session; encouraging active participation in individual and teamwork activities and creating interaction by allocating scores; awarding prizes for high scores; urging students to do the pre-reading assignments and participate in the TBL sessions (14); establishing a structure for developing team application exercises; designing the team application exercises using high-level knowledge approaches (eg, analysis, synthesis, and evaluation); emphasizing the significance of problem analysis, solution finding, decision-making, and reporting; completing the team application exercises ideally by the team members; adhering to the team application exercises scenarios during the sessions and with group discussions; allocating sufficient time for the team application exercises (not exceeding 2.5 hours); using the backward approach in designing the team application exercises; constructing team application exercises regarding challenging issues; and using a checklist to evaluate the questions before the TBL sessions.

3.6. Important Factors in the Development of Appropriate Team Application Exercises

These factor are comprised of identifying the significant problems, dealing with the problems, ensuring specific answer choices, and encouraging simultaneous reporting (14, 22).

3.6.1. Facilitator's Skills and Responsibilities in Team-Based Learning

3.6.1.1. Facilitator's Intellectual or Knowledge-Based Skills

These skills include learning team activities, inspiring discussions within and without the team, encouraging the team to interact by group discussions on how to reach the team's goals, and specializing the role of the facilitator in social/managerial/organizational/intellectual contents.

3.7. Facilitator's Social Role

This role encompasses creating a suitable atmosphere for the sessions, encouraging active engagement, eliciting response from the team and asking follow-up questions if necessary, and accepting the individual features of the other team members.

3.8. Facilitator's Managerial and Organizational Role

This role demands developing TBL rules, creating discussions with emphasis on a better understanding of the goals and monitoring the discussions by walking during the session, inviting the passive members to have active participation, providing a schedule that includes TBL components (iRAT and gRAT) and team application exercises, and seeking to maintain the learners' commitment until the end of the session.

3.9. Facilitator's Rational Role

This role incorporates stimulating the learners' thinking by structuring appropriate questions, linking the learning objectives to the team application exercises, providing informal feedback, and summarizing the salient points.

3.10. Facilitator's Content Expert Role

This role consists of guiding the discussion in test preparation and team activities.

3.11. Facilitator's Responsibilities in Team-Based Learning

These responsibilities take account of forming and preserving TBL groups, instilling accountability in the students for individual and teamwork activities, providing frequent and timely feedbacks, and designing team application exercises to promote learning and teamwork (13).

3.12. Main Points in Facilitating Discussion in Team-Based Learning

3.12.1. Techniques to Encourage Students to Actively Participate in the Team and Submit Comments

These techniques involve walking amongst the students during the discussion, engaging the passive students, and asking the students to take part in discussion with the peers holding opposing views.

3.13. Techniques of Drawing Attention in Large Groups

These techniques include granting the students adequate time to solve the problem; reminding the learners of the time allocated; reminding the learners of the allocated time once more half way through the test; issuing a reminder 4 minutes and, subsequently, 1 minute prior to the end of the allotted time; and adding an extra minute if there is a large number of students.

3.14. Factors Stimulating the Discussion

These factors encompass asking the learners about the reason for their choice of answer, expressing the reasons for supporting the other options, inquiring why the students opted not to choose the other answers, and refraining from providing answers to the questions in iRAT and gRAT to encourage the learners to ask questions in the group test with a view to forging optimal interaction and teamwork.

3.15. Summarizing the Discussion

This component aims at encouraging the students to discuss the challenges with which they had to contend and summarizing and highlighting the principal points (23).

Several studies have underscored the significance of the creation of a favorable environment in TBL and collaborative learning to motivate students (26-28). This objective can be achieved by fostering a positive attitude amongst faculty members and incentivizing them to utilize new methods and instructional technology (29-33). A study by Roh et al showed that pre-reading assignments, course content, peer assessment, and group assignments were factors influencing the learners' satisfaction can develop effectiveness of the course (34).

4. Conclusions

In summary, it is crucial that educational executives take into account the prerequisites of TBL implementation in 2 areas: pre-implementation infrastructure and execution. This objective can be met through the creation of 3 underlying substrates of space and time resources, human resources and the development thereof, and planning and management. Requirements during the implementation of TBL comprise learner orientation phase, process elements, and human resources skills. Fulfilling these requirements can foster positive attitude and support amongst administrators, faculty members, and students and play a significant role in the success of plans to shift the curriculum of medical universities to a more TBL-oriented approach.

Authors' Contributions

Study concept and design: Fatemeh Keshmiri; acquisition of data: Maryam Karbasi and Atena Rahmati Najarkolai; drafting of the manuscript: Maryam Karbasi and Fatemeh Keshmiri; critical revision of the manuscript for important intellectual content: Atena Rahmati Najarkolai; administrative, technical, and material support: Maryam Karbasi and Atena Rahmati Najarkolai; study supervision: Fatemeh Keshmiri.

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