

Research Article

The Perception of Physiologists Toward Implementing Team-based Learning in Sudan: A national-scale Cross-sectional Study

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Abstract

Background: Team-based Learning (TBL) is a teaching approach that fosters active learning and promotes the application of knowledge; its implementation remains sporadic and on a volunteering basis in Sudan. The aim of this study was to investigate the perception of Sudanese physiologist concerning the implementation of TBL.

Methods: This descriptive cross-sectional study included all physiologists in Sudan during 2018. Data were collected using qualitative and quantitative methods, namely, questionnaire and nominal group technique (NGT), respectively.

Results: This study was the first national-scale study on TBL in Sudan, the study adds to the evidence of the benefits of TBL: improving the engagement of students, enhancing deep learning, and providing better instructor–student interaction. Furthermore, TBL was perceived to be of good use in tutorials. However, although TBL is perceived well by instructors, its implementation revealed two main challenges: first, the attendance of the students (and therefore their engagement) is a place of concern mostly because TBL is not well-allocated in the curricula of most medical schools and second, the substantial effort of preparation of TBL material and sessions will put a burden on the staff, rendering them less enthusiastic.

Conclusion: Fostering TBL requires administrative support and training to the staff, as well as proper incorporation of TBL in the curriculum.

Keywords: education, team-based learning, deep learning, physiology

1. Introduction

Team-based Learning (TBL) is a teaching approach that fosters active learning. It was introduced in the 1970s for business education (1). TBL includes both individual and team

works with feedbacks provided instantly (2-5). It engages participants with the kinds of problems they will encounter in real practice in the future (6).

TBL is a teaching approach that is made of units of teaching, each one is known as "module," those modules are arranged to be taught in a series of three steps: step one is "Readiness Assurance Process," or RAP, which is conducted before the session; step two is the "individual Readiness Assurance Test" or iRAT; and step three is the "group/team Readiness Assurance Test," or tRAT. The students' grades are assembled from combining the individual's and groups' scores. The objectives of TBL are achieved through the interaction between group members, number of the members in the group, well-designed objectives, and good preparation. Therefore, the instructor in TBL is considered a leader.

The traditional approach of lectures and practical sessions has become inadequate for the students to build an excellent base to depend on in the following clinical years. Not many works of literature discuss this, however, TBL can be used as a method to teach physiology revisions and tutorials.

The physiology course in Sudanese medical schools is taught in two years (four semesters) in the form of lectures and practical sessions. Although, since 2004, TBL has been applied globally, it was not implemented in Sudanese medical schools as a learning method until recently.

The aim of this study was to understand the perception of Sudanese physiologists about implementing TBL.

2. Materials and Methods

2.1. Study design

This descriptive cross-sectional mixed-method study included all physiologists in Sudan during 2018 ($n = 60$). Data were collected using qualitative and quantitative methods, namely, questionnaire and nominal group technique (NGT), respectively.

A five-point Likert's scale questionnaire was adopted from a similar study. Sociodemographic and academic background variables were added to the questionnaire. The final form of the questionnaire was validated by two experts in health professions education; the confirmatory factor analysis showed an adequate validity, which was then piloted in a group of 33 Sudanese physiologists (outside Sudan) in which Cronbach's Alpha was >0.7 . Cronbach's alpha is a tool for measuring the reliability of a given set of data, it was developed by Lee Cronbach in 1951 (7) and it is widely used to measure

the internal consistency. The result is given as a correlation in which the higher the correlation, the higher the reliability.

The questionnaire comprised of the following 10 items:

1. TBL prompts students in the learning process.
2. With TBL, I do not have to worry about the classroom attendance of the students.
3. I spend much time listening and observing than making formal presentations.
4. Compared to the traditional curriculum, TBL enables weaker students to successfully complete and stay on track in their coursework.
5. TBL prompts the acquisition of knowledge.
6. TBL prompts a depth of understanding.
7. With TBL, I have developed personally rewarding relationships with students.
8. TBL can be successfully employed in large classes.
9. When it comes to tutorials, TBL is the best option.
10. I spend much time preparing for the TBL session.

NGT is a procedure used to facilitate effective group decision. It is a tool for qualitative data collection. NGT is easy in application and effective in terms of efficiency and cost. This technique aims to create items and reach a consensus about those discussion-generated items. It includes a face-to-face meeting based on a predesigned structure and can take up to 2 hr. The group can be composed of five to nine participants. The participants were sat in a comfortable private room, each of them was given a paper containing the questions and was asked to write the answers in the space provided in the paper individually. The facilitator gave them time to answer and then wrote the questions and the answers provided by each participant on a provided board. After that, the discussion started, and the facilitator asked them to select the most suitable answers from the answers provided on the board. The answers were then ranked first, second, and third according to the participants' votes.

Ordinal data obtained from the participants' responses to the questionnaire were converted to quantitative data. The collected data were analyzed using the Statistical Package of Social Sciences (SPSS); they were summarized and presented as mean, median, and standard deviation, the significance level was set at the 95% confidence interval (CI).

3. Results

A total of 60 people participated in this study. Their responses were collected in structured questionnaires and NGT. The participants' age were aged 25–65 years (mean 34.6 ± 7.71). The years of teaching experience ranged between 1 and 35 years; while most of them were lecturers with a master's degree (>60%), the experience in TBL implementation ranged between 1 and 10 years.

4. Discussion

The results showed that a third of the participants are not uncertain about the classroom attendance when using TBL, which is inconsistent with a similar study conducted in a biochemistry course which reported that the majority of teachers agree with TBL and that they don't have to worry about student's attendance (8). The authors have utilized NGT to explore this matter (Question 1 in Table 2), the participants agreed that the main reason is the attendance (most of the semester's attendances are taken from lectures), this will not motivate the students to attend other activities. It also indicates that the current hidden curricula rely on the lectures as the primary instructional method, and as physiologists implement TBL, the curricula (and the general context as well) imply to the student that any activity other than lectures are "just an accessory," effective implementation of TBL requires fostering the culture of active learning among students as well as their instructors. In other words, TBL needs to be integrated and rooted in both the course design and context of teaching (9).

Compared to traditional methods, participants agreed that TBL elevates the level of the weaker students (10) other studies have replaced some of the anatomy lectures with TBL sessions; it showed improvement in students' performance in the final exam scores compared to the previous years. Comparing with the traditional methods of teaching physiology, Adam M. Persky noted that using more TBL within a physiology course had a favorable impact on student's retention of material and attitudes toward the course. Another interesting study suggested that TBL can be a good option that carries the advantages of both traditional and small group learning (5, 9, 11).

TBL established a higher body of knowledge according to the majority (88%) of the participants, and more than half of them (56.7%) felt that TBL promotes deep levels of understanding, this input supports the body of the evidence that suggests the higher performance of medical students in examinations is related to TBL (9, 12, 13). Furthermore, TBL allows students to increasingly resolve more complex scenarios and

TABLE 1: Perception and attitude of participants toward team-based learning.

Questions	Strongly agree N (%)	Agree N (%)	Uncertain N (%)	Disagree N (%)	Strongly disagree N (%)	Mean rating	Total no. of responses	Cronbach's alpha
Q1. TBL prompts students in the learning process	31 (51.7)	26 (43.3)	3 (5)	0 (0)	0 (0)	3.47	60	0.712
Q2. With TBL, I don't have to worry about the classroom attendance of the students.	11 (18.3)	16 (26.7)	20 (33.3)	10 (16.7)	3 (5)	2.37	60	0.755
Q3. I spend much time listening and observing than making formal presentations.	15 (25)	33 (55)	6 (10)	6 (10)	0 (0)	2.95	60	0.748
Q4. Compared to the traditional curriculum, TBL enables weaker students to successfully complete and stay on track in their coursework.	21 (35)	28 (46.7)	9 (15)	2 (3.3)	0 (0)	3.13	60	0.707
Q5. TBL prompts the acquisition of knowledge.	26 (43.3)	27 (45)	7 (11.7)	0 (0)	0 (0)	3.32	60	0.708
Q6. TBL prompts a depth of understanding.	34 (56.7)	20 (33.3)	4 (6.7)	2 (3.3)	0 (0)	3.43	60	0.712
Q7. With TBL, I have developed personally rewarding relationships with students.	27 (45)	22 (36.7)	9 (15)	2 (3.3)	0 (0)	3.23	60	0.700
Q8. TBL can be successfully employed in large classes.	10 (16.7)	29 (48.3)	13 (21.7)	6 (10)	2 (3.3)	2.65	60	0.725
Q9. When it comes to tutorials, TBL is the best option.	28 (46.7)	26 (43.3)	5 (8.3)	1 (1.7)	0 (0)	3.35	60	0.716
Q10. I spend much time preparing for the TBL session.	12 (20)	35 (58.3)	8 (13.3)	5 (8.3)	0 (0)	2.90	60	0.745

problems, it also fosters higher levels of understanding (14, 15). In physiology, with TBL, there is a high level of information retention by the students . According to McInerney

TABLE 2: Perception of participants using nominal group technique (NGT).

Questions	Participants' opinions	Final answers	Voting score	Rank
1- Why are you uncertain about student's attendance when using TBL?	<p>Participant 1: Students think perhaps these are the exam questions, they don't have to come, and they can take the questions with the answers later from their colleagues who attended.</p>	1. Most of the semester's attendances are taken from lectures.	1, 1, 1 = 3	1st
	<p>Participant 2: Most of the students believe that the tutorials are unhelpful. Most of the semester's attendances are taken from lectures.</p>	Unsuitable time (at the end of the day)	1, 1 = 2	2nd
	<p>Participant 3: Unsuitable time (at the end of the day) No strict rules for attendance in tutorials.</p>	Most of the students believe that the tutorials are unhelpful.	1 = 1	3rd
2- When it comes to tutorials, TBL is the best option. (why?)	<p>Participant 1 - Because the students can learn from the discussion that happens during the sessions even if they are not prepared in advanced, unlike problem-based learning (PBL). - It is cost-effective.</p>	Because students can learn from the discussion between the members and the final discussion with the teacher.	1, 1, 1 = 3	1st
	<p>Participant 2 - Not the best option for a tutorial because it is difficult to assess each student separately, especially when the number is large. - Unlike PBL, it does not contain open-ended questions.</p>	Encourages students to come prepared for the tutorial.	1, 1 = 2	2nd
	<p>Participant 3 Good option because students can be evaluated using I-Rat. Encourages students to study.</p>			
3- Why do you spend much time preparing for the TBL session?	<p>Participant 1 - Finding suitable questions for discussion. - Student's survey to find weak and high academic students to mix them together.</p>	Finding suitable questions for discussion (lack of standard questions bank).	1, 1, 1 = 3	1st
	<p>Participant 2 -Same ideas as the first participant.</p>	Just initially but with experience is going to be easy and fast.	1, 1 = 2	2nd
	<p>Participant 3 - Just initially but with experience is going to be easy and fast. - Unlike PBL, lack of standard questions bank.</p>	Student's survey to find weak and high academic students to mix them together.	1 = 1	3rd

and Fink, TBL motivates learners, and provides them with skills for resolving complex problems (16).

According to the participants in this study, TBL helps in developing a positive teacher–student relationship. Similar results were reported by [13] Persky and Pollack, and Chhabra *et al.* (8, 17). Our study showed that participants perceive TBL as a process that can be applied to a large group. Almost 50% of the participants agreed that TBL could be done with large number of students; results from studies in physiology courses reflect the same conclusions (11).

Most of the participants (90%) felt that the best option for tutorials is TBL. After discussion with the participants using the NGT, the most voted answer was *TBL is the best option for tutorials because students can learn from the discussion between the members and the final discussion with the teacher*. This result is consistent with a study conducted by Amalladonna *et al.* (18) which compared traditional ways of teaching with the TBL technique in tutorial teaching in physiology education. Facilitation in TBL differs from facilitation of other modalities of the small group settings (19).

More than half of the participants agreed that they spend much time preparing for the TBL than other teaching methods. Putting this question for discussion in NGT, the participants agreed that there should be a questions bank for TBL just like PBL. They also suggested that much time is spent only at the beginning of the semester, the initial TBL sessions (i.e., preparing the cards, the classroom, and mixing the students according to their academic performances), after which the process will go smoothly. The substantial effort of preparation of TBL material and sessions will put a burden on the staff, rendering them less enthusiastic, this requires administrative support as well as proper incorporation of TBL in the curriculum.

5. Conclusion

This is the first national-scale study on TBL in Sudan, the study adds to the evidence of the benefits of TBL: improving the engagement of students, enhancing deep learning, and providing better instructor–student interaction. Furthermore, TBL was perceived to be of good use in tutorials. However, although TBL is perceived well by instructors, its implementation remains sporadic, and on a volunteering basis, this raised two concerns. First, the attendance of the students (and therefore their engagement) is a point of concern mostly because TBL is not well-allocated in the curricula of most medical schools and second, the substantial effort of preparation of TBL material and sessions will put a burden on the staff, rendering them less enthusiastic.

Recommendation

Fostering TBL requires administrative support and training to the staff, as well as proper incorporation of TBL in the curriculum; development of a questions bank for TBL is also recommended.

Limitations

All physiologists in Sudan at the time of the study were included, they all had a reasonable experience in TBL; however, their experiences are variable and range from all -year implementation to frequent implementation, therefore, the variation between their experiences must be considered.

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Ethical considerations

The study protocol was approved by the Institutional Review Board, Al-Neelain University (IRB).

Competing interests

The authors report no conflict of interest.

Availability of data and material

Data are stored in a local electronic store and will be available upon reasonable request.

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Authors' contributions

MET worked on the study concept and literature search. The study methodology was finalized by MET and HEEG. Data acquisition, data analysis, and statistical analysis were performed by MET and DMEA. Manuscript preparation, editing, and review were done by DMEA and HEEG. The final version of the manuscript was approved by HEEG.

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References

- [1] Hrynchak P, Batty H. The educational theory basis of team-based learning. *Med Teach*. 2012;34(10):796-801.
- [2] Thompson BM, Schneider VF, Haidet P, Levine RE, McMahon KK, Perkowski LC, et al. Team-based learning at ten medical schools: two years later. *Med Educ*. 2007;41(3):250-7.
- [3] Johnson DW J, R. T. Learning together and alone: Cooperative, competitive, and individualistic learning Boston: Allyn & Bacon; 1999.
- [4] Shankar N, Roopa R. Evaluation of a modified team based learning method for teaching general embryology to 1st year medical graduate students. *Indian J Med Sci*. 2009;63(1):4-12.
- [5] Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: a practical guide: AMEE guide no. 65. *Med Teach*. 2012;34(5):e275-87.
- [6] Levine RE, O'Boyle M, Haidet P, Lynn DJ, Stone MM, Wolf DV, et al. Transforming a clinical clerkship with team learning. *Teach Learn Med*. 2004;16(3):270-5.
- [7] Tavakol M, Dennick R. Making sense of Cronbach's alpha. *International journal of medical education*. 2011;2:53.
- [8] Chhabra N, Kukreja S, Chhabra S, Chhabra S, Khodabux S, Sabane H. Team-based Learning Strategy in Biochemistry: Perceptions and Attitudes of Faculty and 1(st)-Year Medical Students. *Int J Appl Basic Med Res*. 2017;7(Suppl 1):S72-S7.
- [9] Parmelee DX, Michaelsen LK. Twelve tips for doing effective Team-Based Learning (TBL). *Med Teach*. 2010;32(2):118-22.
- [10] Vasan NS, DeFouw DO, Holland BK. Modified use of team-based learning for effective delivery of medical gross anatomy and embryology. *Anat Sci Educ*. 2008;1(1):3-9.

- [11] Srivastava TK, Waghmare LS, Jagzape A, Mishra V. Interactive intragroup tutorials: a need-based modification to enhance learning in physiology. *Adv Physiol Educ.* 2015;39(4):414-5.
- [12] Koles PG, Stolfi A, Borges NJ, Nelson S, Parmelee DX. The impact of team-based learning on medical students' academic performance. *Acad Med.* 2010;85(11):1739-45.
- [13] Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: a practical guide: AMEE guide no. 65. *Medical teacher.* 2012;34(5):e275-e87.
- [14] Sibley J, Parmelee DX. Knowledge is no longer enough: Enhancing professional education with team-based learning. *New Directions for Teaching and Learning.* 2008;2008(116):41-53.
- [15] Punja D, Kalludi SN, Pai KM, Rao RK, Dhar M. Team-based learning as a teaching strategy for first-year medical students. *Australas Med J.* 2014;7(12):490-9.
- [16] McInerney M F, L. D. . Team-based learning enhances long-term retention and critical thinking in an undergraduate Microbial Physiology course. *Journal of Microbiology & Biology Education* 2003;4:3-12.
- [17] Persky AM, Pollack GM. A modified team-based learning physiology course. *Am J Pharm Educ.* 2011;75(10):204.
- [18] Amalladonna AV, Pujari DK, Patil SS. A Comparative Study of Team-Based Learning on the Traditional Method of Conducting Tutorials in Physiology for First Year Mbbs Students. *Journal of Evidence Based Medicine and Healthcare.* 2017;4(38):2291-4.
- [19] Gullo C, Ha TC, Cook S. Twelve tips for facilitating team-based learning. *Med Teach.* 2015;37(9):819-24.