# Introduction of team-based learning among undergraduate medical students studying General Medicine

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**Abstract**
**Introduction:** Various teaching-learning (TL) methods are used in medical education, including traditional lectures, case studies, and problem-based learning. Team-Based Learning (TBL) is an active learning method where students work in small groups to enhance problem-solving skills, teamwork, and apply conceptual knowledge. TBL fosters intellectual, social, and personal development, and allows a single teacher to manage multiple groups simultaneously.

**Aim and Objectives:** The study aimed to introduce and assess undergraduate medical students' perceptions of TBL as a teaching tool.

**Methodology:** This prospective interventional study involved 150 phase-3 part-2 undergraduate medical students, divided into five teams of 30. The TBL session was conducted in three phases: (1) Team formation, (2) Individual and team readiness assurance tests (iRAT and tRAT), and (3) Application of knowledge to real-life clinical problems. A standardized questionnaire assessed students' perceptions of TBL.

**Conclusion:** TBL was successfully implemented among undergraduate students and faculty, showing improved student performance and active participation. Over 90% of students reported enhanced critical thinking and better understanding of concepts through teamwork. Both students and faculty expressed support for more TBL sessions, highlighting its potential to contribute significantly to medical education.

**Keywords:** Team-Based Learning (TBL), Medical education, Readiness assurance tests (iRAT, tRAT), Student perceptions

## I. Introduction

Various teaching-learning (TL) methods are used in medical education, including traditional lecture-based learning, case studies, problem-based learning, and other active learning approaches [1-2]. Lecture-based learning is the most common method, being efficient and cost-effective for transmitting knowledge [2]. However, it is teacher-centered with minimal active student participation [3].

Team-based learning (TBL), an active learning method, involves students working in small groups to apply conceptual knowledge, enhancing problem-solving skills and teamwork among medical students [4]. TBL promotes active participation, fostering intellectual, social, and personal development. It allows a single teacher to manage multiple small groups in large classes. Studies indicate TBL is feasible and effective in medical education.

TBL occurs in three phases. First, students complete a reading assignment based on faculty-derived learning objectives. Second, they demonstrate knowledge through an individual readiness assurance test (iRAT) and a team readiness assurance test (tRAT), where they first complete a quiz individually and then with their team. In the final phase, teams apply concepts and critical thinking to solve problems [5-6]. This study aims to assess undergraduate medical students' perceptions of TBL.

## II. Method

This prospective interventional study involved 150 undergraduate medical students in phase-3 part-2. The Team-Based Learning (TBL) session was divided into three phases. In Phase 1, students were grouped into five teams of 30 members each. In Phase 2, the students individually completed a test (iRAT) on given topic, followed by a team based test (tRAT) where they discussed the same questions. Phase 3 involved solving real-life clinical problems using their knowledge and critical thinking. A standardized questionnaire was used to assess students' perceptions of the TBL experience.

## III. Result

Total 148 undergraduate students perusing MBBS who came for their postings in general medicine department of KDMCH participated in this study.

**Table-1: Showing phase wise scoring by students in MCQs test.**

| | Students scoring <50% marks | Students scoring 50-75% marks | Students scoring >75% marks |
|---|---|---|---|
| | n=148 | n=148 | n=148 |
| Phase-2 (iRAT) | 24 (16.2%) | 82 (55.4%) | 42 (28.4%) |
| Phase-2 (tRAT) | 2 (1.3%) | 16 (10.8%) | 130 (87.8%) |
| Phase-3 (tRAT) | 2 (1.3%) | 14 (9.5%) | 132 (89.1%) |

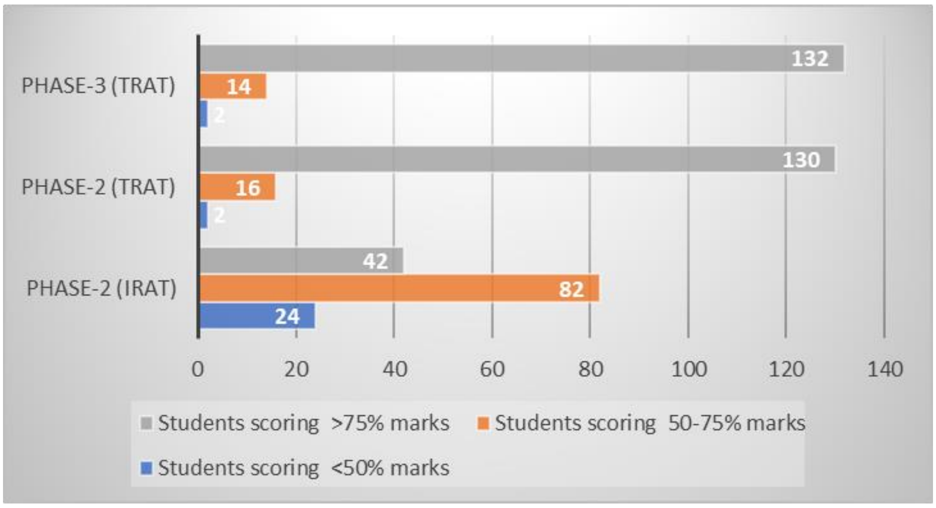


**Figure-1: Graph Showing phase wise scoring by students in MCQs test.**

Assessment of score of phases 1, 2 and 3 sessions: Results of MCQs score of iRAT in phase 2 were 24 (16.2%) students scoring <50% marks, 82 (55.4%) students scoring between 50 - 75% marks and 42 (28.4%) students scoring >75% marks and after successful team-based learning session result of tRAT showed only 2(1.3%) student scoring <50% marks, 16 (10.8%) students scoring 50-75% marks and 130

(87.8%) students scoring >75% marks. In phase 3 tRAT 2(1.3%) student scoring <50% marks, 14 (9.5%) students scoring 50-75% marks and 132 (89.1%) students scoring >75% marks.

**Table-2: showing mean scoring in MCQs test**

| MCQs Marks | Lowest score (max marks = 20) | Highest score (max marks = 20) | Mean score (max marks = 20) |
|---|---|---|---|
| Phase-1 (iRAT) | 4 | 18 | 12.87 |
| Phase-2 (tRAT) | 8 | 20 | 17.83 |
| Phase-3 (tRAT) | 8 | 20 | 17.91 |

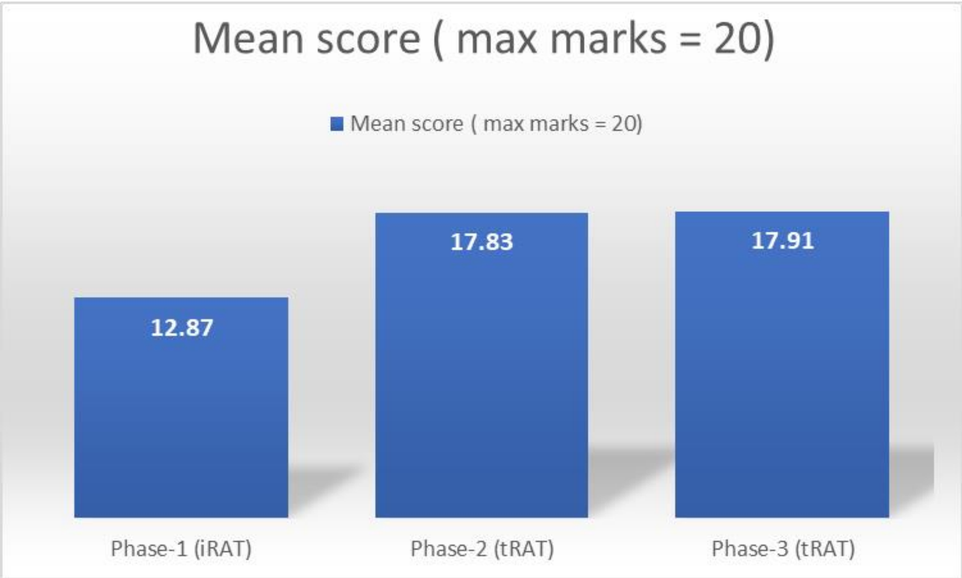


**Figure-2: Bar Graph showing mean scoring in MCQs test**

The mean score obtained by students was 12.87,17.83,17.91 respectively with lowest score of 04/20 ,08/20 and 08/20 respectively in the three phases. Whereas highest score was 18/20 in phase 1 and 20/20 in phase 2 and 3.

**Perception of students towards TBL**:

Following table showing perception from students about TBL at the end of session.

**Table-3: showing perception from students about TBL at the end of session**

| Total sample size (n)=148 | **Strongly Agree (n=148)** | **Agree (n=148)** | **Neutral (n=148)** | **Disagree (n=148)** | **Strongly disagree (n=148)** | **Likert Score Mean** |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| During the TBL discussion, I paid attention most of the time. | 82 (55.4%) | 58 (39.2%) | 6 (4%) | 2 (1.3%) | 0 | 4.47 |
| Team readiness assurance test (tRAT) helped me in understanding the assigned topic well | 84 (56.7%) | 56 (37.8%) | 6 (4%) | 2 (1.3%) | 0 | 4.48 |
| TBL develops team working and critical thinking | 70 (47.3%) | 62 (42.3%) | 16 (10.8%) | 0 (0%) | 0 | 4.36 |
| TBL is in coordination with other course elements (lectures, clinical and practical skills) | 78 (52.7%) | 64 (43.2%) | 4 (2.7%) | 2 (1.3%) | 0 | 4.02 |
| TBL helped me in understanding difficult material by hearing my classmates | 72 (48.6%) | 64 (43.2%) | 10 (6.7%) | 2 (1.3%) | 0 | 4.39 |
| TBL reduced my stress and developed leadership qualities | 76 (51.3%) | 58 (39.2%) | 12 (8.1%) | 2 (1.3%) | 0 | 4.40 |
| TBL improves the teacher student relationships | 72 (48.6%) | 68 (46.0%) | 8 (5.4%) | 0 (0%) | 0 | 4.43 |
| Mistakes were improved by my peers without causing any embarrassments during TBL session | 68 (46.0%) | 66 (44.6%) | 12 (8.1%) | 2 (1.3%) | 0 | 4.35 |
| TBL is an innovative teaching method to impart knowledge in students | 72 (48.6%) | 60 (40.5%) | 16 (10.8%) | 0(0%) | 0 | 4.37 |
| More TBL sessions should be implemented in future | 80 (54.0%) | 48 (32.4%) | 18 (12.2%) | 2 (1.3%) | 0 | 4.39 |

The response rate towards the questionnaire was 100% i.e. all the students responded to. Analysis of questionnaire on perception of students showed that 94.6% students agreed that most of the time they were attentive during TBL sessions however, 4% of the students had a neutral opinion about their span of attention during sessions. Majority (94.5%) of the students felt that tRAT helped them to understand the assigned topic well and only 5.3% students disagreed with this point. 89.6% of students agreed that TBL developed team working/critical thinking and was in coordination with course elements, respectively whereas10.8 %students were neutral towards it, but none of the student disagreed with the same.

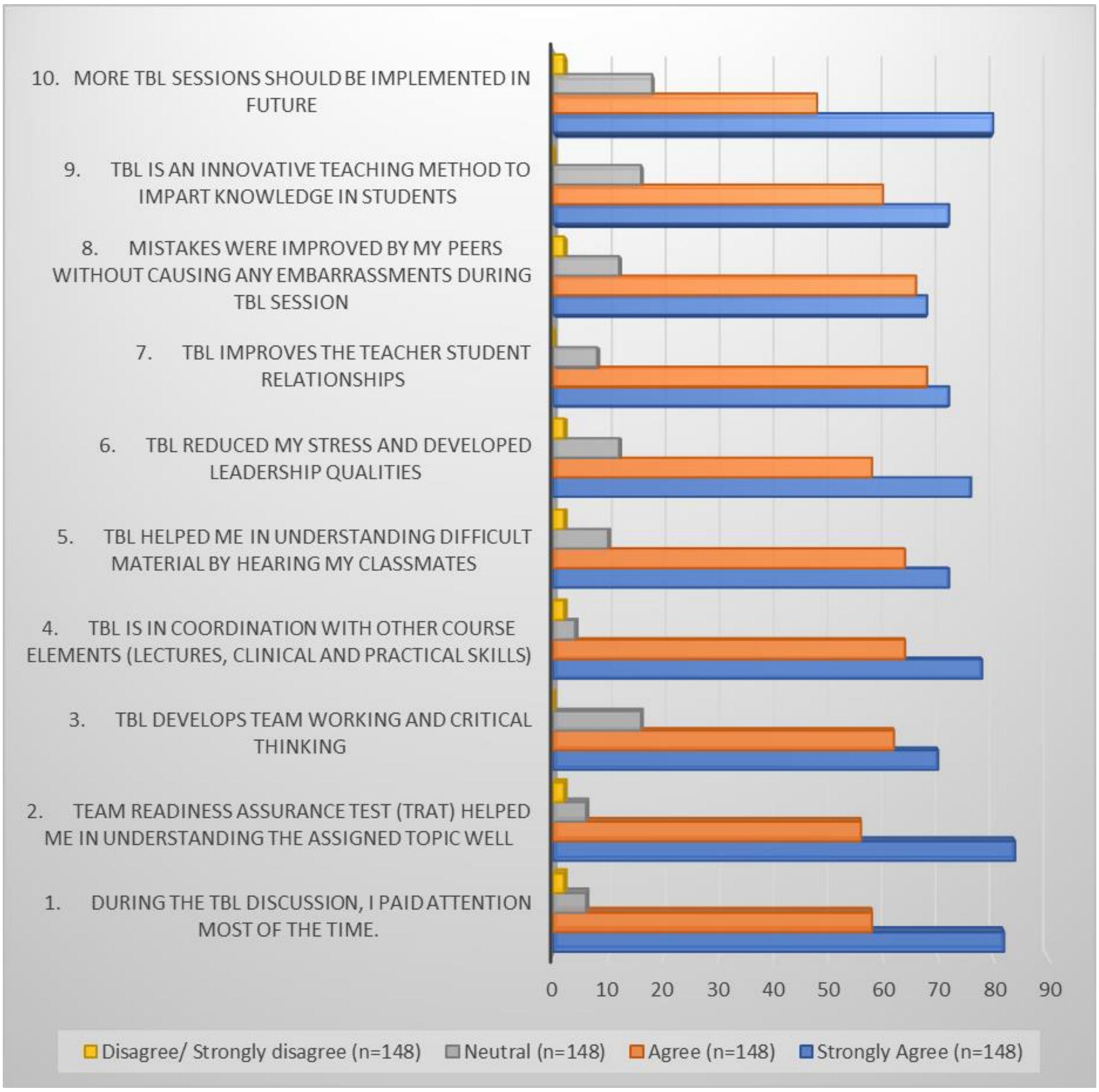


**Figure-3: Graph showing perception from students about TBL**

A 91.8% of students agreed that TBL helped them to understand the difficult course material by hearing their classmates however, only 1.3% students disagreed to this statement. Majority (94.6%) of students perceived that TBL session helps to improve teacher student relationship to surprise none disagreed. A 89.1% of students agreed that TBL is an innovative TL method to impart knowledge, opinion of 10.8% students remained neutral and no student disagreed. 86.4% students felt that more TBL sessions should be conducted in future and only 1.3% students disagreed with this statement.

**Perception of faculties towards TBL: -**

All 12 (100%) faculty members completed the questionnaires related to perception towards TBL. A 8/12 (66.6%) faculty agreed that TBL sessions were well-framed in coordination with other course material whereas, 16.6% faculty members remained neutral and 16.6% members disagreed for this statement. A 91.6% faculty agreed and 16.6% remained neutral on statement of questionnaire that TBL helped in improving the teacher student relationship however, no faculty disagreed on this statement.

**Table-4: showing perception from faculty about TBL at the end of session.**

| Total (n)=12 | **Strongly Agree** | **Agree** | **Neutral** | **Disagree** | **Strongly disagree** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| During the TBL discussion, I paid attention most of the time. | 4 (33.3%) | 5 (41.6%) | 2 (16.6%) | 1 (8.3%) | 0 (0%) |
| TBL was conducted well within time frame and it covered all information of the topic | 5 (41.6%) | 5 (41.6%0 | 2 (16.6%) | 0 (0%) | 0 (0%) |
| TBL helps the teachers to improvise their relationship with the students | 6 (50%) | 5 (41.6%) | 1 (8.3% | 0 (0%) | 0 (0%) |
| TBL is an innovative teaching method to develop critical thinking and imbibe subject knowledge in the students | 5 (41.6%) | 5 (41.6%) | 2 (16.6%) | 0 (0%) | 0 (0%) |
| TBL was well framed in coordination with other course elements (Lecture, clinical and practical skills) | 4 (33.3%) | 4 (33.3%) | 2 (16.6%) | 2 (16.6%) | 0 (0%) |

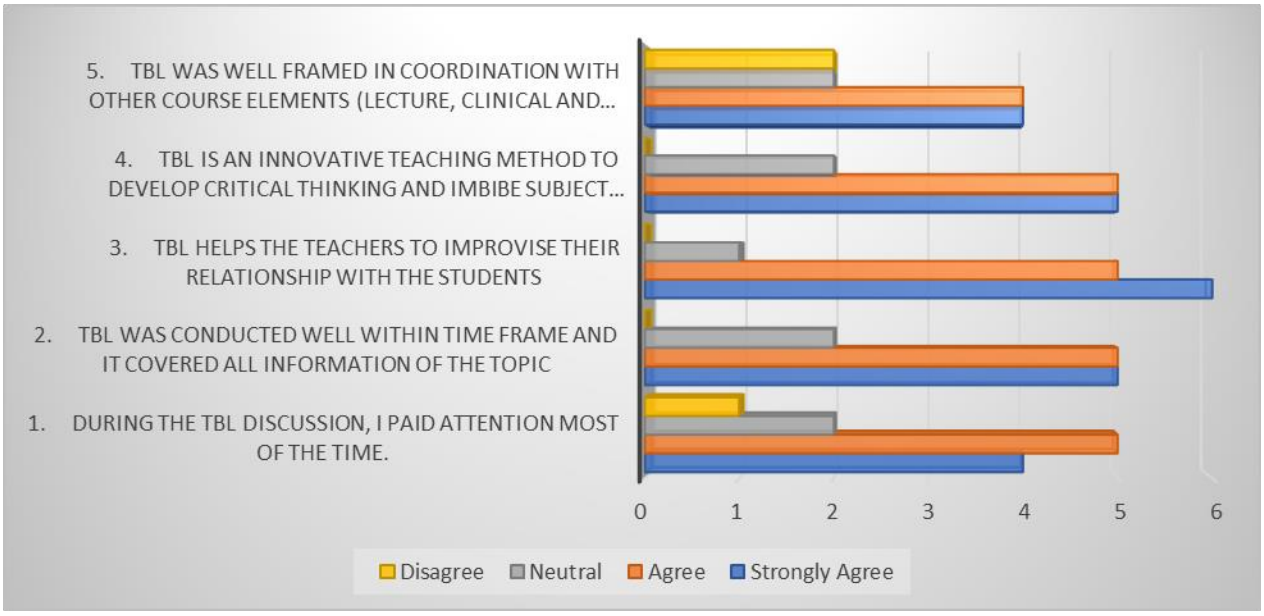


**Figure-4: Graph showing perception from students about TBL at the end of session.**

Majority (83.2%) faculty felt that TBL was conducted within time frame and it covered all information on the suggested topic.

## IV. Discussion

In traditional lectures, students typically sit quietly and listen to a lecture delivered by a teachers(7), This style has been accepted in university education for many years because it allows large numbers of students to be taught simultaneously(8). TBL strategy was developed in the business school environment in the early 1990s by Dr Michaelsen who wanted the benefits of small group learning within large classes. Currently, TBL is used in over 60 international health science professional schools teaching medicine, dentistry, veterinary medicine, nursing, and allied health disciplines and at all levels of training: undergraduate, postgraduate, and continuing professional education.

However, it is important that students can summarize the lecture content, and explain their opinions to others. To cultivate students' ability to debate, universities have used practical training, report preparation, and presentation sessions. it can be difficult to find time for these and passive lectures often constitute the majority of university education(9).

When TBL is conducted according to standard formats, it has been observed that academic outcomes are

equivalent or superior in comparison to lecture-based formats or traditional small group learning models
The prevalence of team-based learning in medical schools is increasing. Students take advantage of the knowledge they have gained in the discussion of problem solving in teams and get the opportunity to get instant feedback about the solutions they produce as a team. Taking into account the responsibility of learning to the class prepared incomes to apply their individual and team related information will then use this information to solve the problems given in the classroom through inter team discussions[10,11].
Present study was undertaken to introduce TBL among the undergraduate medical students in the subject of general medicine as well as to find out perception of students and faculties towards implementation of this new teaching learning method.Results of study indicate that response of the students as well as of faculty members were positive towards implementation of TBL strategy.
Analysis of scoring of different phases of TBL method showed that performance of students significantly improved when they performed in team as there was a significant improvement in the scores of tRAT of both phase-2 and phase-3 when compared with iRAT of phase-2.
In present study, more than 94.6% of students agreed that they paid attention most of the time during TBL session.
Harakuni SU et al., also found that 62% students in their study felt that they were actively engaged during TBL session[12].
94.5% of students perceived that TBL improved their existing knowledge on concepts by hearing their classmates and also was useful for clinical problem-solving skills both as an individual and as a team. Similarly, Harakuni SU et al., observed that 66% of students in their study felt that TBL session provided additional knowledge acquired through lectures while in another study 62.35 students agreed that TBL helped me to obtain a higher level of knowledge[12].
Okubu Y et al., and Yang LH et al., also showed that 50% and 66% students, respectively in their studies agreed that they achieved discussion skills on clinical problem solving through TBL session[13,14].
During the tRAT sessions discussions occurring among students during develop a critical thinking skill and also made students think in depth about the topic, which helped them clear their concepts. It was found than the retention of knowledge was of longer duration.
On team work related questionnaire, 90.6% of students stated that during TBL session their mistakes were improved by peers without causing any embarrassments which was far better from the Previous studies which reported that around 37.6% for this statement with mean score of 4.25±0.92. [9–15] and 3.89±0.92.[16]
In present study 86.4% students told that More TBL sessions should be implemented in future as compare to study done by Altintas L et al., in their study found that 76% students agreed on further conduction of TBL sessions [17].
Regarding perception of teachers towards improvement in relationship between teacher and students by TBL, 91.6% faculty members felt that TBL helps to improvise relationship of teachers. Contrarily, Chhabra N et al., found 100% faculty perceived that TBL developed rewarding relationship with the students[18]. In the present study, positive experience with the implementation of TBL and high evaluation results of students and faculty perception was in coordination with previous studies conducted in several countries across the globe.
In the end its pretty much clear with the findings of this study that TBL is a major cost-effective active TL methodology which emphasize the critical thinking, analysis skills, problem solving methodology, leadership skills and clinical scenario reasoning of students by focusing on the applied clinical knowledge and developing skills among them to analyze the difficult clinical case scenario. TBL utilizes the power of small group learning in a large classroom setting facilitated by a single faculty.
Increasing the number of applications based on teamwork and increasing the number of academic studies on this subject will provide valuable contributions to medical education. It seems possible for well-established team-based applications to take place more widely in medical education and it is inevitable that team-based learning becomes an effective training method.

## V. Conclusion

The TBL was successfully introduced among undergraduate students and faculty members at our institute. There was noteworthy improvement in the scores Students thereby signifying that the students enjoyed and participated well in all the TBL sessions as reflected by given assignments. More than 90% of students

remained attentive during TBL sessions and responded that TBL helped them to develop critical thinking and their concepts on assigned topic became more understandable when they performed as team. Interestingly both the students and faculties felt that more such sessions should be implemented in future.
Increasing the number of applications based on teamwork and increasing the number of academic studies on this subject will provide valuable contributions to medical education. It seems possible for well-established team-based applications to take place more widely in medical education and it is inevitable that team-based learning will become an effective training method.

## VI. Reference


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