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The impact of task-based learning on practical intelligence in medical students: A quasi-experimental study

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ABSTRACT

Practical intelligence (PI) is a multi-dimensional concept that includes skills for everyday life, tacit knowledge, and conflict resolution. It also involves creative traits such as perseverance, adaptability, and problem-solving, which are crucial for success in both university and work settings. This study aimed to assess the impact of a task-based learning (TBL) strategy on the practical intelligence of medical students. A total of 121 medical students participated in this quasi-experimental study, divided into two groups: a control group receiving routine teaching and an experimental group using the TBL strategy. Practical intelligence was measured before and after the intervention using a scale specifically developed for university students by the researcher. The results showed that the experimental group scored significantly higher in practical intelligence compared to the control group. The findings also demonstrated that the task-based learning strategy is an effective teaching method for improving the practical intelligence of medical students enhancing their performance in real-world work environments.

1. Introduction

Contemporary students use technology to gain knowledge, develop practical skills and abilities, and often prefer small-class teaching. They favor task-based learning methods, including video presentations, assignments, short tests, and case studies (Olivier, 2021; Sedaghatkar et al., 2023). Therefore, colleges must prepare students for future employment. Individuals must be prepared for job opportunities, which requires providing them with an advanced set of abilities that will prepare them for the future. Positive enhancement of the clinical thinker or researcher's mentality is dependent on innovative teaching methods and an interest in medical research, especially since medical students are characterized by high academic quality, as they are admitted based on very high marks and through the preparatory year at the University.

The task-based learning (TBL) strategy is based on the social constructivist theory, as it sees the student as an active being who acquires knowledge and experiences through social learning. TBL focuses on building the learning process based on the task and not on the learning required to perform the task, and sometimes they need cooperative groups to solve the tasks, so at the present time, it is mainly applied in education for the undergraduate levels in some colleges such as medicine and pharmacy. Virtual laboratory classrooms impact equipment handling, trial-and-error learning, and safe operation of tools and equipment. The value of virtual laboratory classes is completely different from other learning styles, such as lectures and other educational programs (Razali and Trevelyan, 2012).

TBL is defined as an educational curriculum in which students learn the skill of communicating with others by performing a task in the classroom, which requires the teacher's competence in identifying new tasks and choosing activities appropriate to their level to complete the tasks (Ardiyani, 2021). TBL strategy is one of the learning strategies that represent a type of learner-centered learning that aims to achieve educational goals according to individual abilities and differences. It is an educational strategy that relies on manual and mental activities practiced by learners in an interactive atmosphere under the supervision of the course instructor for the purpose of achieving specific goals (Bell, 2010). The importance of

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practical intelligence increases with attention to preparing the medical student for the future and his ability to face the problems of the profession after graduation, as well as exploiting the abilities and potentials by applying the mind to medical issues and challenges. Most directly, physicians need to understand AI in the same way that they need to understand any technology impacting clinical decision-making (McCoy et al., 2020).

PI is the development of experience and implicit knowledge as an indicator of it, so practical intelligence is one of the components of intelligence according to the tripartite theory of intelligence. According to Sternberg (1999), PI is an indicator of positive academic and professional results in successful lives. PI is considered one of the most important manifestations of successful intelligence, which grows with age and experience and can be developed through training in solving problems and through learning from experiences (Sternberg, 2000). Medical education is a continuous process that does not end with students' graduation, and practical intelligence is part of developing creative abilities. Some faculty members rely on the lecture method, some rely on task-based learning, and this may depend on the choice of teaching strategy and perhaps the nature of the course (Harden et al., 2000; Tian et al., 2017). If the goal of education is to raise motivation to learn, innovate, develop skills, and solve problems, it requires advanced educational strategies, especially when teaching medical courses, including the task-based learning strategy.

Practical intelligence (PI) is used to advance oneself in life to adapt to, shape, and select environments to achieve whatever it is that one wants to achieve in life (Sternberg, 2021). PI, as defined by Sternberg (2000), involves adapting an individual's abilities to daily life problems, a predictor of successful academic and occupational outcomes, surpassing traditional IQ tests. Adaptive intelligence faces problems and seeks to solve them, such as epidemics, pollution, weapons, and others that could represent risks for the planet to lose suitable human life (Sternberg et al., 2022). However, PI is a specific context that enables individuals to develop rules and strategies to understand situations and achieve goals. It is based on tacit knowledge acquired through daily experiences. The school curriculum focuses on memory and analytical abilities that serve school tests, and in addition to that, it is required to focus on creative and practical skills based on wisdom (Sternberg, 2018).

2. Literature review

According to Lee (2000), the TBL is learning that depends on a classroom activity or training that has a main goal that is achieved through interaction between its participants and has a sequential method of interaction with a focus on constructing meaning, which requires students to understand, process and produce the required ideas as if they were They perform a set of action plans. TBL depends on self-learning and includes three stages: The pre-task stage, the task implementation stage, and the post-task stage, which teaches specific topics in order to gain concepts and better achieve the objectives of the course. Akpan et al. (2020) explained that social constructivist theory focuses on acquiring knowledge of what students do with peers, which emphasizes the collaborative nature of learning, the use of conversation and interaction with others, and the application of knowledge as an essential aspect of learning and a means of achieving learning goals.

Naha et al. (2012) explored the impact of task-based learning on the overall development of pharmacy students. They used a 12-question survey to gather students' views on the task-based learning process, assessing how well students could apply their skills and technical knowledge. Results showed no gender-based differences; 93% of students indicated that this approach made the subject more interesting, and 91% felt it improved skill application and motivated them to generate innovative ideas. Similarly, Lobo et al. (2015) noted that creative teaching methods, especially problem-based learning (PBL), promote deep learning and enhance clinical thinking by allowing students to solve problems in small groups under the instructor's guidance. Traditional lecture-based learning (LBL), by contrast, offers fewer opportunities for practical application. TBL effectively links skills, knowledge, and competencies (Tian et al., 2017).

TBL enhances student engagement in real-world problem-solving, promoting innovative interdisciplinary collaborations for medical workers and researchers. It breaks down barriers, bridges gaps, and improves communication skills among students, promoting team collaboration and effective learning (Gillis et al., 2015; Shankar et al., 2006; Tian et al., 2017).

TBL is similar to problem-based learning (PBL), but there are essential differences in strategy. In contrast to PBL, TBL focuses on a set of tasks; it offers practical advantages, saves resources, and increases the connections among skills, knowledge, and competencies. In undergraduate education for health professionals, TBL supports the integration of medical knowledge with patient care by providing a context for learning and developing transferable skills. TBL: This model has been used in medical education to foster deep learning across a variety of subjects and educational contexts, benefiting teachers and helping students achieve better results than conventional methods. Because it is more effective in engaging students than lecturing in a large class (Burgess et al., 2020). Medical education relies heavily on task-based learning because it is interactive and improves performance, clinical knowledge, and communication skills among students (Wannasai et al., 2023). In the application phase, students work in small groups to demonstrate the use of teamwork for problem-solving. Clinical problem-solving exercises by students lead to class discussions and instructor comments (Burgess et al., 2020; Wannasai et al., 2023).

Active learning in medical education encourages students to take more responsibility, as it differs from passive lecture-based approaches. TBL improves communication, learning, and motivation among students. To strengthen TBL, instructors could adjust teaching methods and classroom layouts using small groups or smart classrooms (Wannasai et al., 2023). TBL is a clinical teaching strategy that combines learning with real-life patient experiences. Students learn related tasks, understand concepts, and apply them in real clinical situations. TBL focuses on developing basic medical knowledge, communication skills, and problem-solving abilities. It integrates theory and practice, making it an effective clinical teaching strategy for both undergraduates and professionals (Sedaghatkar et al., 2023). TBL is a clinical teaching-learning strategy that is suitable to be combined with microteaching. In TBL, students visit the patients in a real clinical setting and are guided to learn the related tasks by understanding the underlying concepts and mechanisms and then applying the acquired knowledge and skills in other situations (Ozan et al., 2005). Indeed, TBL focuses on not only performing the task but also understanding the relevant basic and clinical medical knowledge (Harden et al., 2000).

PI provides practical solutions to everyday problems and offers strategies for effective work in the environment. It is often not taught clearly or verbally expressed, measured through work-related problems. PI is an active intelligence that ensures success in life, unlike general intelligence. It differs from academic intelligence due to the different types of problems faced in academic situations. Practical problems require formulation, knowledge, and multiple paths to solve, requiring previous experience, motivation, and training in laboratories (Hammadi et al., 2023). The tacit knowledge that an individual uses daily to solve problems contributes to developing his performance and thinking strategies, formulating hypotheses, and developing appropriate solutions. One of the forms of assessing practical intelligence is situational judgment tests, in which the student is presented with a set of work situations in written form, with each situation followed by a set of possible responses. Then, the student is asked to develop the response that he deems most appropriate for him, and the result is given what is called the practical intelligence quotient (PIQ) (Sternberg et al., 2001).

Practical abilities include gaining experience from abstract information and using it to deal with complex daily life problems. Practical intelligence is the ability to use acquired information to solve problems in daily and practical life (Sternberg, 2010; 2010). Some individuals have a high ability to implement components of intelligence in abstract tasks, but they do not know how to apply them in everyday situations. PI is a form of intelligence that has broader applicability than analytical and creative intelligence. It is a skill that allows working in the real world, solving practical problems, and the ability to adapt to the environment and change the situation when needed. It is known as street smarts (Sternberg, 2000; Howard et al., 2001).

PI is the ability of an individual to include all his skills in a practical way in his general life so that he can harmonize his experiences, environment, and behavior (Sternberg and Hedlund, 2002). Practical intelligence develops through practical experiences in laboratories and study and training activities. It is the result of on-the-job learning and is the best indicator of good learning. PI is a skill based on understanding one's environment and achieving goals, and it can be taught in schools. Williams et al. (2002) at Harvard and Yale developed the PIFS (practical intelligence for school) curriculum to enhance this skill. PI is psychologically and statistically distinct from academic intelligence. It is also distinct from personality and styles of thought.

PI is different from the kind of intelligence associated with academic success. We see people who succeed in school and fail in work or who fail to succeed in school but succeed in work (Sternberg, 2000). Exercise patience when working on a class project, work cooperatively with other students to solve mechanical or technical problems of the project, and have confidence that you can solve problems cooperatively (Herrick, 2001). when assigned to a group project in class, follow the rules of the instructor and work with group members to solve problems together despite failures. When working on expensive or dangerous equipment, use good judgment so as not to get hurt or destroy equipment, take calculated risks as a group so you can solve problems without big mistakes, learn from failures and persist as a group, and don't blame group members for failure.

The owner of PI seeks tacit knowledge, identifies strengths and weaknesses, and masters their work. Researchers believe that increasing tacit knowledge helps develop PI by linking learning to daily life problems. Focusing on practical methods in teaching scientific material is crucial, as it helps demonstrate this intelligence and avoids focusing solely on theoretical aspects (Hammadi et al., 2023). Individuals with practical intelligence have the ability to recognize the factors affecting their success and the factors that help them adapt to the environment and shape it to suit them. They have the ability to make practical presuppositions that indicate the ability to learn in everyday life situations (Gottfredson, 2003). They have the ability to formulate and reformulate problems and solve them in several ways, depending on flexibility in solutions to suit changing circumstances. There is no doubt that PI contributes to predicting job performance and that practical intelligence is the result of learning on the job, while general intelligence is the best indicator of learning ability (Razali and Trevelyan, 2012).

Medical education is a lifelong pursuit, and it should be tailored to learners at different career stages. Integrating AI competencies into postgraduate medical education curricula and quality improvement can enhance medical training offerings, either online or in person, and refresh clinicians' competencies (McCoy et al., 2020). The competencies required to effectively work with AI will often overlap with those required to fulfill other core aspects of the physician role, such as advocacy, leadership, and communication. Medical schools have a critical role to play not only in helping their students learn but also in nurturing their academic interests and sowing the seeds of future leadership (McCoy et al., 2020).

According to Brinkman et al. (2017) and Mokrzecki et al. (2023), Medical students' skills in learning to prescribe medications increase through hands-on training, simulation-based training, role-playing sessions, and small group work. Sternberg's problem-solving model, in conjunction with the Triarchic Theory of intelligence, emphasizes the importance of metacognition. This model consists of six higher-order processes: Problem identification, resource allocation, information representation and organization, strategy formulation, monitoring, and solution evaluation. Sternberg argues that metacognition plays a crucial role in problem-solving, as it helps individuals identify problems, allocate resources, organize information, formulate strategies, monitor progress, and evaluate solutions (Muammar, 2006).

The purpose of advancing practical intelligence was to demonstrate that success in everyday life is more than just academic knowledge or thinking modes. Practical intelligence is defined as the ability to perform successfully in naturalistic settings in a way consistent with one's goals, enabling adaptive solutions to ill-defined problems. Practical intelligence involves learning and developing skills, contrasting with academic intelligence, which focuses on intellectual abilities. High practical intelligence enables quick and confident problem-solving, contrasting with academic intelligence, which focuses on recalling theories and making academic judgments.

Medical students possess analytical and creative abilities that must be translated into a practical form, starting with diagnosing disease cases based on cognitive foundations, the disease symptoms approved for each case, describing the treatment plan, and making the correct decision for treatment, all of this requires a high degree of practical intelligence. Perhaps task-based learning is a great opportunity to develop aspects of scientific intelligence in various academic curricula and field training in hospitals.

Therefore, this study aimed to answer the following three questions:

1. What are the levels of the study sample on the practical intelligence scale?
2. Are there differences between the average scores of the research sample on PI according to gender?
3. Is there a significant difference in the mean ranks of PI between the pre-graduation and internship training groups (using the TBL)?

3. Materials and methods

3.1. Research design

The researcher adopted the experimental research style, plus a control group with a post-test, which is one of the real designs as it represents the TBL independent variable and the PI dependent variable. The research community consisted of all students at Medicine College. As for the research sample, the researcher intentionally chose 55 students who enrolled in internship training to be the experimental group. In addition, 66 pre-graduation students will be the control group teaching without the TBL strategy.

3.2. Participants

The research population included all graduate students at the College of Medicine at Faisal University in Al-Ahsa, totaling 1,200 male and female students in the 2023-2024 academic year. The research tool was administered to the entire sample, with 121 students completing the questionnaire. Table 1 shows the distribution of the sample based on relevant variables and factors. The sample was intentionally selected and divided into two groups: an experimental group taught using task-based learning and a control group that was not. Both groups were matched for gender, age, and study status.

Table 1: Distribution of the research sample, according to its variables and factors

Variables	Factors	n	%
Gender	Male	68	56.20
	Female	53	43.80
Education	Pre-graduation	66	62.81
	Internship training	55	37.19
Total		121	100%

3.3. Instruments

The Practical Intelligence Scale (PIS) was developed by the researcher after reviewing existing measures of practical intelligence, which were found unsuitable for the study's purpose and sample. This new scale aimed to assess the level of practical intelligence in graduate students. Student responses were rated on a 5-point Likert scale (always, almost, sometimes, rarely, or never) with corresponding scores of 5, 4, 3, 2, and 1. To verify the scale's validity, internal consistency was measured in a pilot sample of 78 graduate students (male and female) from the College of Medicine at King Faisal University. The correlation among the scale's dimensions ranged from 0.489 to 0.891, and reliability was confirmed using Cronbach's Alpha, which was 0.862. These findings indicate the scale achieved an acceptable level of validity and reliability.

4. Results

To answer research question 1: “What is the level of PIS of students of medicine college from their point of view?” the mean and standard deviation of the survey responses were calculated. The results are given in Table 2. According to Table 2, the overall mean score was 2.724, with a standard deviation of 0.217, suggesting that students exhibit a high level of practical intelligence. The highest-ranked item was Item 15, "In high school, I was passionate about solving mechanical problems," with a mean score of 2.906 and a standard deviation of 0.292. The second-ranked item was Item 10, "I prefer solving problems that contain a great deal of ambiguity," with a mean of 2.892 and a standard deviation of 0.311. Item 27, "I care about setting practical steps to reach results," ranked third, with a mean of 2.884 and a standard deviation of 0.320. Item 18, "I participate in group work within academic projects," ranked twenty-sixth, with a mean of 2.706 and a standard deviation of 0.453. Finally, Item 22, "I learn easily from a professor who uses a variety of teaching methods," was ranked twenty-seventh, with a mean of 2.626 and a standard deviation of 0.493.

To answer research question 2: "Are there statistically significant differences between the responses of students on the PIS according to gender?" Table 3 shows that the t-value was 7.791, and the p-value was <0.001, which is below the 0.05 threshold. This indicates statistically significant differences in the mean scores of the study sample on the PIS according to gender.

To answer research question 3: "Are there statistically significant differences in the mean ranks of PIS between the pre-graduation and internship training groups (using the TBL)? Table 4 shows the differences between the pre-graduation and internship training of respondents regarding PIS, where the t-value was 6.319 and the p-value was <0.001. This value is higher than 0.05, indicating that there were differences in the means of the study sample in PIS due to education.

Table 2: Descriptive statistics of the PIS level of respondents (n=121)

No.	Items	Mean	Standard deviation	Rank
1	I tend to achieve excellent results in objective and practical tests	2.834	0.443	10
2	I learn practical things and enjoy succeeding in them	2.454	0.715	25
3	I rely on practical experiments to verify the results	2.870	0.414	5
4	I learn more from my personal experience than from formal lessons	2.625	0.542	22
5	I love coming up with new practical ideas to solve problems	2.863	0.344	6
6	I don't like long theoretical lectures	2.848	0.432	8
7	I prefer engaging in practical experiments and procedures	2.661	0.474	20
8	I plan well to make an interactive presentation	2.784	0.412	13
9	I plan well to create a schedule for studying and educational activities	2.640	0.589	21
10	I prefer solving problems that contain a great deal of ambiguity	2.892	0.311	2
11	I apply what I have learned from various sources to solve educational problems	2.702	0.514	18
12	I believe that solving problems requires practical intelligence	2.697	0.460	19
13	I think problem-solving focuses on finding solutions to old problems	2.856	0.352	7
14	From high school, I plan to attend a practical college	2.877	0.328	4
15	In high school, I was passionate about solving mechanical problems	2.906	0.292	1
16	Read the lessons in advance and prepare questions for discussion	2.841	0.366	9
17	I keep the expensive equipment in my college	2.827	0.379	11
18	I participate in group work within academic projects	2.706	0.453	26
19	I work on the computer for a long time preparing presentations	2.762	0.427	15
20	I prefer watching videos of complex surgeries	2.712	0.510	17
21	Choose to participate in highly challenging projects	2.805	0.397	12
22	I learn easily from a professor who uses a variety of teaching methods	2.626	0.493	27
23	I follow with great focus lessons based on modeling and role-playing	2.741	0.439	16
24	I make sure to attend practical education in teaching hospitals	2.777	0.417	14
25	I have the ability to transform ideas into practical reality	2.477	0.727	24
26	I can apply what I learned in theoretical courses to practical life situations	2.611	0.558	23
27	I care about setting practical steps to reach results	2.884	0.320	3
	Mean for total	2.724	0.217	

Table 3: The results of the independent samples t-test test showing the differences between respondents according to gender

	Group	N	Mean	Standard deviation	T	df	p
PIS	Male	68	82.155	3.415	7.791	67	<0.001
	Female	53	78.751	4.832			

Table 4: The results of the t-test test between the pre-graduation and internship training groups

	Group	N	Mean	Standard deviation	T	df	p
PIS	Pre-graduation	66	54.73	2.929	6.319	65	<0.001
	Internship training	55	57.21	2.509			

5. Discussion

The results of the study revealed that it is clear from the results that medical students possess high levels of practical intelligence, based, of course, on analytical and creative intelligence, as indicated by Sternberg in his theory of successful intelligence. This indicates that the medical profession does not depend solely on the amount of information that students obtain from references, books, and lectures but rather depends on employing this wealth of knowledge in solving daily medical problems that are related to understanding the symptoms of flatulence, the history of the case, the necessary medical examinations for each case, and reading and interpreting radiology reports. Correctly, whether it is an X-ray, an MRI, or a CT scan, In addition to how to write a prescription and make medical decisions, according to McCoy et al. (2020), Medical schools must equip physicians with curricular and extracurricular learning opportunities on clinical usage, technical limitations, and ethical implications of artificial intelligence. This will ensure a strong base of AI literacy among physicians. There is no doubt that training and intervention programs contribute to enhancing skills indicating practical intelligence, as Mokrzecki et al. (2023) pointed out that the impact of educational interventions on prescribing skills in medical students, revealing improvements in skills but gaps in definition, teaching methods, assessment methods, prescription types, and educator background. Moreover, an individual who is characterized by practical intelligence is able to apply, employ, and put things into practice and benefit from them.

Employing cognitive concepts contributes to professional life and the real world because this helps enhance individuals' practical skills and direct their attention to acquiring knowledge through which they can adapt to life's circumstances (Sternberg et al., 2015). Sternberg et al. (2015) pointed out that developing practical intelligence requires making tacit knowledge explicit and clear and improving the ability of individuals to acquire tacit knowledge through the environments in which they live. Practical intelligence embodies success in putting knowledge to use in practical practice, which reflects the ability to effectively implement ideas and solutions (Myers and Dewall, 2015). Practical intelligence is linked to general intelligence, emotional intelligence, and the prevailing culture in society (Fox and Spector, 2000), and social attractiveness is part of practical intelligence, as the charisma of individuals grows to play an effective role in practical intelligence if the individual uses it well (Sternberg, 2005).

Females are distinguished by their ability to analyze, use expressive language, solve problems, explain, compare, and classify. They also have analytical abilities based on memory, memorization, vocabulary analysis, analysis of reading passages, attention, analysis, and familiarity with abstract words. Males are characterized by practical aspects, putting knowledge into practice in a way that suits preferred learning methods, overcoming obstacles, and the ability to work and convince others of the value of their efforts and their practical application in life situations.

The differences between pre-graduation students and final-year students with internship training in favor of final-year students in practical intelligence. The explanation for this is that relying on a task-based learning strategy contributed significantly to planning and problem-solving, which are major pillars of practical intelligence. This result is partly consistent with the results of a study (Shenoy et al., 2022a). Early clinical exposure programs in medical curricula require many skills. Preclinical task-based learning is a simulated learning approach that can be utilized in early clinical exposure programs in which the focus for students is a real task done by a medical professional. TBL includes the vertical integration and amalgamation of theory and practice. The knowledge, skills, and attitudes are learned in the same setting in which they must be applied.

TBL was structured as a continuum of the existing preclinical PBL program in the School of Medicine for Five years as an alternative educational model for clinical clerkship, facilitated the integration of preclinical and clinical components of the curriculum within a flexible framework, contributed to the acquisition of holistic and interdisciplinary approaches, enhanced student motivation and satisfaction, and promoted student learning (Ozkan et al., 2006). The effectiveness of preclinical task-based learning TBL in providing early clinical exposure to first-year medical students. TBL involves real-life tasks done by doctors, with students discussing learning issues. However, they suggested future improvements to improve the usefulness of TBL could be useful for other clinically relevant topics in medical schools (Shenoy et al., 2022b).

Shenoy et al. (2022a) compared preclinical task-based learning TBL among first-year medical students and compared it to traditional tutorials in physiology. The results showed that TBL students scored significantly higher in multiple-choice question (MCQ) and objective structured clinical examinations (OSCE) tests than the tutorial group. Students' perspectives on TBL compared to other types of learning; they like the participatory element of the modules. Furthermore, they believed that the technique was distinct from other typical small-group teaching tactics like problem-based learning, team-based learning, and tutorials, which are commonly used in the preclinical curriculum.

Advocates of the theory of successful intelligence argue that intelligence includes creative skills to generate new ideas, analytical skills to assess these ideas, and practical skills to implement them effectively and persuade others of their worth. They believe that individuals use knowledge and creativity to benefit society (Sternberg, 2015). In sum, PI is a skill that can be learned and improved over time based on 'tacit knowledge' shaped by personal experiences. It is not inherited but can be developed through personal experiences, mistakes, and others. PI allows individuals to process information without effort, enabling them to navigate life effectively.

There are many studies on the importance of the task-based learning strategy in different societies and samples around the world in China, Germany, Nepal, and America that confirm the benefits of this strategy with medical, dental, and pharmacy students (Ardiyani, 2021; Naha et al., 2012; Olivier, 2021; Shenoy et al., 2022b).

The subject of the study requires more in-depth research to verify the relationship between practical intelligence and active learning methods and to conduct more training and guidance programs to enhance the components of successful intelligence, including practical intelligence, and make optimal use of employing TBL strategy and the preferred learning methods among medical students.

Despite the positive results of this research, several limitations were encountered. The researcher relied on a questionnaire about practical intelligence, which may affect the accuracy of the data used in the study. In addition, the research was conducted in Medicine College only, and samples from other universities were not included. Therefore, the results may be greatly affected by the limited sample and cannot be generalized. Researchers can conduct studies of the factors affecting creativity, especially practical intelligence, among medical students in different specialties. These studies may contribute to verifying the results of focusing on TBL strategy across different contexts. Comparing other learning strategies with the TBL strategy gives a clearer picture of facing the challenges that limit the effectiveness of the TBL strategy.

In addition, the attention of the teaching staff must be drawn to the importance of the role of practical intelligence along with analytical intelligence and TBL strategy in developing communication skills, empathy, and the relationship between theory and practice in the field of health care and the practice of medicine.

6. Conclusions

Task-based learning may play a significant role in clinical education, particularly when combined with other clinical teaching strategies that promote learning through brief, targeted units. These combined approaches can improve both knowledge and practical intelligence in medical students. This study focused on task-based learning's impact on enhancing practical intelligence among medical students, noting differences by gender and study status. Task-based learning extends beyond a simple educational method, offering benefits highlighted by many researchers, such as improved communication, engagement, performance, responsibility, quality of medical education, and integration of analytical and practical skills.

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Compliance with ethical standards

Ethical considerations

This study received ethical approval from the King Faisal University Ethics Committee, and all participants provided informed consent. Confidentiality and participant rights were maintained throughout.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Akpan VI, Igwe UA, Mpamah IBI, and Okoro CO (2020). Social constructivism: Implications on teaching and learning. British Journal of Education, 8(8): 49-56.

Ardiyani DK (2021). Implementing task-based learning (TBL) for learning German in Indonesia. KnE Social Sciences, 2021: 105-116. https://doi.org/10.18502/kss.v5i3.8532

Bell S (2010). Project-based learning for the 21st century: Skills for the future. The Clearing House, 83(2): 39-43. https://doi.org/10.1080/00098650903505415

Brinkman DJ, Tichelaar J, Schutte T, Benemei S, Böttiger Y, Chamontin B, Christiaens T, Likic R, Maˇiulaitis R, Marandi T, and Monteiro EC (2017). Essential competencies in prescribing: A first European cross-sectional study among 895 final-year medical students. Clinical Pharmacology and Therapeutics, 101(2): 281-289. https://doi.org/10.1002/cpt.521 **PMid:27648725 PMCid:PMC5260337**

Burgess A, Bleasel J, Hickson J, Guler C, Kalman E, and Haq I (2020). Team-based learning replaces problem-based learning at a large medical school. BMC Medical Education, 20: 492. https://doi.org/10.1186/s12909-020-02362-4 **PMid:33287811 PMCid:PMC7720476**

Fox S and Spector PE (2000). Relations of emotional intelligence, practical intelligence, general intelligence, and trait affectivity with interview outcomes: It's not all just 'G.' Journal of Organizational Behavior, 21: 203-220. https://doi.org/10.1002/(SICI)1099-1379(200003)21:2<203::AID-JOB38>3.3.CO;2-Q

Gillis AE, Morris MC, and Ridgway PF (2015). Communication skills assessment in the final postgraduate years to established practice: A systematic review. Postgraduate Medical Journal, 91(1071): 13-21. https://doi.org/10.1136/postgradmedj-2014-132772 **PMid:25468984**

Gottfredson LS (2003). Dissecting practical intelligence theory: Its claims and evidence. Intelligence, 31(4): 343-397. https://doi.org/10.1016/S0160-2896(02)00085-5

Hammadi SS, Majeed BH, and Hassan AK (2023). Impact of deep learning strategy in mathematics achievement and practical intelligence among high school students. International Journal of Emerging Technologies in Learning, 18(6): 42-52. https://doi.org/10.3991/ijet.v18i06.38615

Harden, Crosby, Howie, and Struthers (2000). Task-based learning: The answer to integration and problem-based learning in the clinical years. Medical Education, 34(5): 391-397. https://doi.org/10.1046/j.1365-2923.2000.00698.x **PMid:10760125**

Herrick MJ (2001). The validity of practical intelligence measures as constructs in the context of academic and vocational programs in high school. Ph.D. Dissertation, University of Minnesota, Minneapolis, USA.

Howard BC, McGee S, Shin N, and Shia R (2001). The triarchic theory of intelligence and computer-based inquiry learning. Educational Technology Research and Development, 49: 49-69. https://doi.org/10.1007/BF02504947

Lee JF (2000). Tasks and communicating in language classrooms. McGraw-Hill, New York, USA.

Lobo A, Cámara CDL, Campos R, Ventura T, Marco C, Campayo A, Dourdil F, Barcones MF, and Saz P (2015). Innovative methods in teaching psychiatry to medical students. The European Journal of Psychiatry, 29(1): 67-78. https://doi.org/10.4321/S0213-61632015000100006

McCoy LG, Nagaraj S, Morgado F, Harish V, Das S, and Celi LA (2020). What do medical students actually need to know about artificial intelligence? NPJ Digital Medicine, 3: 86. https://doi.org/10.1038/s41746-020-0294-7 **PMid:32577533 PMCid:PMC7305136**

Mokrzecki SM, Mallett A, Sen Gupta T, Perks S, and Pain T (2023). Do educational interventions improve prescribing skills of medical students compared to no additional learning? A systematic review. Medical Education Online, 28(1): 2259166. https://doi.org/10.1080/10872981.2023.2259166 **PMid:37722675 PMCid:PMC10512866**

Muammar OM (2006). An integration of two competing models to explain practical intelligence. Ph.D. Dissertation, University of Arizona, Tucson, USA.

Myers DG and Dewall CN (2015). Psychology. 11th Edition, Worth Publishers, Duffield, UK.

Naha A, Pai KG, Nayak UY, Reddy MS, Koteshwara KB, and Udupa N (2012). Implementation of task based learning for overall development of pharmacy students. Research Journal of Pharmacy and Technology, 5(2): 291-294.

Olivier J (2021). Creating microlearning objects within self-directed multimodal learning contexts. In: Corbeil JR, Khan BH, and Corbeil ME (Eds.), Microlearning in the digital age: 169-188. Routledge, 1st Edition, New York, USA. https://doi.org/10.4324/9780367821623-15

Ozan S, Karademir SEDAT, Gursel YUCEL, Taskiran HC, and Musal BERNA (2005). First graduates' perceptions on a problem-based and task-based learning curriculum. Education for Health, 18(2): 256-271. https://doi.org/10.1080/13576280500148007 **PMid:16009619**

Ozkan H, Degirmenci B, Musal B, Itil O, Akalin E, Kilinc O, Ozkan S and Alici E (2006). Task-based learning programme for clinical years of medical education. Education for Health, 19(1): 32-42. https://doi.org/10.1080/13576280500534826 **PMid:16531300**

Razali ZB and Trevelyan J (2012). An evaluation of students' practical intelligence and ability to diagnose equipment faults. In: Yusof KM (Ed.), Outcome-based science, technology, engineering, and mathematics education: Innovative practices: 328-349. IGI Global, Pennsylvania, USA. https://doi.org/10.4018/978-1-4666-1809-1.ch016

Sedaghatkar F, Mohammadi A, Mojtahedzadeh R, Gandomkar R, Rabbani Anari M, Dabiri S, and Zoafa S (2023). Enhancing medical students' knowledge and performance in otolaryngology rotation through combining microlearning and task-based learning strategies. International Journal of Environmental Research and Public Health, 20(5): 4489. https://doi.org/10.3390/ijerph20054489 **PMid:36901499 PMCid:PMC10001912**

Shankar RP, Dubey AK, Mishra P, Deshpande VY, Chandrasekhar TS, and Shivananda PG (2006). Student attitudes towards communication skills training in a medical college in Western Nepal. Education for Health, 19(1): 71-84. https://doi.org/10.1080/13576280500534693 **PMid:16531304**

Shenoy R, Jain A, Bhagyalaksmi K, Shirali A, Shetty S, and Ramakrishna A (2022b). Evaluation of preclinical task based learning program in medical education. F1000Research, 11: 282. https://doi.org/10.12688/f1000research.109913.1 **PMid:37767073 PMCid:PMC10521084**

Shenoy R, Jain AKB, Shirali A, Shetty SB, and Ramakrishna A (2022a). A task-based learning strategy in preclinical medical education. Advances in Physiology Education, 46(1): 192-199. https://doi.org/10.1152/advan.00173.2020 **PMid:34591690**

Sternberg RJ (1999). Successful intelligence: Finding a balance. Trends in Cognitive Sciences, 3(11): 436-442. https://doi.org/10.1016/S1364-6613(99)01391-1 **PMid:10529799**

Sternberg RJ (2000). Practical intelligence in everyday life. Cambridge University Press, Cambridge, UK.

Sternberg RJ (2005). The theory of successful intelligence. Revista Interamericana de Psicología/Interamerican Journal of Psychology, 39(2): 189-202.

Sternberg RJ (2010). Assessment of gifted students for identification purposes: New techniques for a new millennium. Learning and Individual Differences, 20(4): 327-336. https://doi.org/10.1016/j.lindif.2009.08.003

Sternberg RJ (2015). Successful intelligence: A model for testing intelligence beyond IQ tests. European Journal of Education and Psychology, 8(2): 76-84. https://doi.org/10.1016/j.ejeps.2015.09.004

Sternberg RJ (2018). Why real-world problems go unresolved and what we can do about it: Inferences from a limited-resource model of successful intelligence. Journal of Intelligence, 6(3): 44. https://doi.org/10.3390/jintelligence6030044 **PMid:31162471 PMCid:PMC6480790**

Sternberg RJ (2021). Adaptive intelligence: Surviving and thriving in times of uncertainty. Cambridge University Press, Cambridge, UK. https://doi.org/10.1017/9781316650554

Sternberg RJ and Hedlund J (2002). Practical intelligence, g, and work psychology. In: Viswesvaran C and Ones DS (Eds.), Role of general mental ability in industrial, work, and organizational psychology: 143-160. Psychology Press, 1st Edition, New York, USA. https://doi.org/10.4324/9781410608802-9

Sternberg RJ, Castejón JL, Prieto MD, Hautamäki J, and Grigorenko EL (2001). Confirmatory factor analysis of the Sternberg triarchic abilities test in three international samples: An empirical test of the triarchic theory of intelligence. European Journal of Psychological Assessment, 17(1): 1-16. https://doi.org/10.1027//1015-5759.17.1.1

Sternberg RJ, Chowkase A, Parra-Martinez FA, and Landy J (2022). Criterion-referenced assessment of intelligence as adaptation to the environment: Is it possible, plausible, or practical? Journal of Intelligence, 10(3): 57. https://doi.org/10.3390/jintelligence10030057 **PMid:35997413 PMCid:PMC9397071**

Sternberg RJ, Grigorenko EL and, Jarvin L (2015). Teaching for wisdom, intelligence, creativity, and success. Skyhorse, New York, USA.

Tian Y, Li C, Wang J, Cai Q, Wang H, Chen X, Liu Y, Mei F, Xiao L, Jian R, and Li H (2017). Modified task-based learning program promotes problem-solving capacity among Chinese medical postgraduates: A mixed quantitative survey. BMC Medical Education, 17: 153. https://doi.org/10.1186/s12909-017-0994-0 **PMid:28882184 PMCid:PMC5590117**

Wannasai K, Rottuntikarn W, Sae-ung A, Limsopatham K, and Dankai W (2023). Preclinical medical student satisfaction of team-based learning in Chiang Mai University. The Asia Pacific Scholar, 8(4): 36-39. https://doi.org/10.29060/TAPS.2023-8-4/SC3000

Williams WM, Blythe T, White N, Li J, Gardner H, and Sternberg RJ (2002). Practical intelligence for school: Developing metacognitive sources of achievement in adolescence. Developmental Review, 22(2): 162-210. https://doi.org/10.1006/drev.2002.0544