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Comparison of the effects of group and individual reflection methods on self-regulated learning strategies and learning motivation among emergency medical technicians: a quasi-experimental study

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Abstract

Background Reflection is an essential educational practice often characterized as a self-regulated learning activity. Self-regulated learning has been shown to positively influence learning motivation and metacognition. This study aimed to compare the effect of group and individual reflection methods on self-regulation learning strategies and motivational components among emergency medical technicians.

Methods This quasi-experimental study was conducted on 54 emergency medical technicians in South Khorasan province in 2023. Thirty pre-hospital emergency centers affiliated to Birjand University of Medical Sciences were randomly assigned to three blocks (A, B, and C). Participants were then selected through convenience sampling based on predetermined inclusion and exclusion criteria. Eighteen participants working in pre-hospital emergency centers were selected from each block. The three blocks (A, B, and C) were randomly assigned into three arms: individual reflection, group reflection, and control. The individual reflection group members were asked to record their feelings and experiences using the Gibbs model in provided notebooks during four weeks (at the end of each week). The group reflection members, after forming groups and selecting leaders, engaged in the group reflection sessions in a designated room, following the Gibbs model for four weeks. The self-regulated learning strategies and learning motivation components of all participants were measured using standardized questionnaires before and after the intervention. Data were analyzed using paired t-test, one-way analysis of variance, Tukey's post hoc test, and Fisher's exact test.

Results The mean score of self-regulation learning strategies and learning motivation significantly increased in the group reflection arm after the intervention ($p < 0.05$). While the mean scores of motivational component and its individual components increased significantly in the individual reflection group after the intervention ($p < 0.05$), no

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significant difference was observed in the mean scores of self-regulation learning strategies and their components before and after the intervention ($p > 0.05$).

Conclusion The results of this research highlight the superiority of group reflection method over individual reflection in promoting self-regulated learning. While both methods were effective in enhancing learning motivation, group reflection proved to be more beneficial. Therefore, it is recommended that Emergency Medical Services managers provide training programs that incorporate group reflection to enable technicians to benefit from its advantages in terms of self-regulated learning strategies and learning motivation.

Keywords Reflection, Pre-hospital emergency, Self-regulated learning strategies, Learning motivation

Background

Emergency Medical Services (EMS) is a critical component of healthcare systems and it seems necessary to improve treatment outcomes in emergency situations [1]. Pre-hospital emergency personnel as a subgroup of EMS are the first responders, responsible for providing pre-hospital emergency care in various emergency scenarios [2]. However, providing care in prehospital environments is more difficult and unpredictable than in controllable hospital settings [3].

Many Pre-hospital emergency personnel lack the skills and knowledge to provide effective care in emergencies [2]. Aslan et al. (2021) found that pre-hospital emergency medical staff had limited skill and knowledge of simple triage and rapid treatment (START) [4]. Additionally, Rowland (2022) showed that most pre-hospital emergency personnel were unfamiliar with crisis resource management (CRM) or lacked enough information about its principles and practices. Pre-hospital emergency care personnel are expected to have enough knowledge, experience, and excellent clinical judgment skills to make accurate clinical decisions and act optimally in unstructured, dynamic pre-hospital environments [5]. In pre-hospital emergency services, education plays an essential role in providing employees with the necessary knowledge and skills for effective and timely care [2].

Reflection is an integral and essential aspect of teaching and learning healthcare professions [6]. It is also essential for developing therapeutic relationship, professional expertise, and self-regulated lifelong learning [7]. Reflection allows Pre-hospital emergency personnel the opportunity to reflect on their actions and errors, recognize how their thoughts, feelings and emotions affect decision-making processes [8].

While reflection often occurs after an event or situation, it can occur before, during, and after it. When reflection precedes a situation, it can guide individuals to approach it with specific learning objectives or to challenge their existing understanding. This proactive approach can lead to personal development and learning. In other words, it can be considered as a self-regulated learning activity [7].

Self-regulation involves managing thoughts, feelings, and attitudes to achieve personal goals [9]. Self-regulated learning has positive relationship with academic performance, learning motivation, and metacognition. Learning motivation influences learners' interest, effort, and commitment to learning tasks, guiding their perception of task value, goal orientation, interest, and persistence [10].

Pre-hospital emergency personnel, as first responders in emergency situations, must make accurate clinical decisions and manage emergencies effectively to optimize patient outcomes. However, research suggests that emergency personnel often struggle with decision-making and emergency management. Self-regulated learning strategies and motivation can enhance skill acquisition and in-depth learning of these items in emergency personnel, and reflective thinking is an educational method that can improve self-regulated learning and motivation.

Despite the potential benefits, research on the impact of reflection methods on self-regulated learning strategies and learning motivation among Pre-hospital emergency personnel is limited. Therefore, we conducted this study to compare the effects of group and individual reflection methods on self-regulation learning strategies and learning motivation components among EMTs.

Methods

Study design

This quasi-experimental study with non-equivalent groups design was conducted in 2023.

Participants

Considering a previous study [11] and based on a power of 0.80 and a type I error (α) rate of 0.05, a sample size of 18 participants per group was estimated. For selecting participants, 30 pre-hospital emergency centers affiliated to Birjand University of Medical Sciences in South Khorasan province were randomly assigned to three blocks (A, B, and C). This is done to prevent data contamination due to interactions between personnel working in the same centers. Convenience sampling was used to recruit 18 participants from each block, adhering to specific inclusion and exclusion criteria. Inclusion criteria were

willingness to participate in research and possession of at least an associate degree in medical emergencies, a bachelor's degree in nursing, or an associate degree in nursing. Exclusion criteria included employment in the administrative or dispatch unit of pre-hospital emergency services or failure to attend one or more reflection
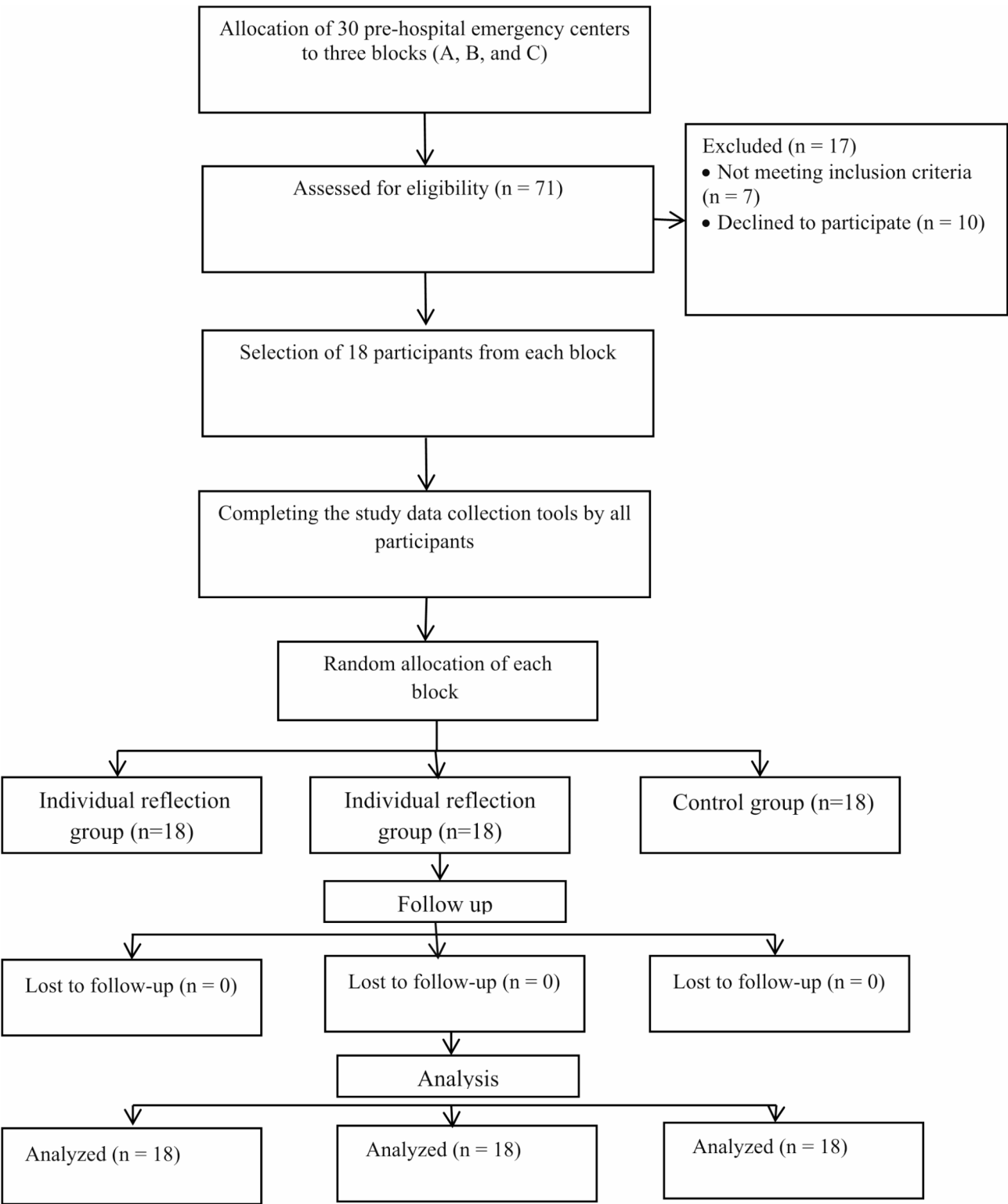

Fig. 1 Flow chart of the study

sessions. All 54 selected participants completed demographic information forms, the Motivational Strategies for Learning Questionnaire (MSLQ), and the Motivation toward Science Learning questionnaire (SMTSL) at baseline (T0). The baseline data was collected by a researcher assistant. Participants were Recruited from 21 August 2023 to 25 November 2023. Subsequently, the three blocks (A, B, and C) were randomly assigned into the individual reflection arm, the group reflection arm, and the control arm, respectively by a researcher assistant (Fig. 1).

Data collection tools

This study used a demographic information form, the MSLQ, and the SMTSL to collect data. The demographic information form included information about participants' work experience in pre-hospital emergency, age, marital status, education level, and major.

MSLQ, developed by Pintrich and DeGroot (1990), is a 47-item questionnaire assessing motivational belief and self-regulated learning strategies. The motivational beliefs scale includes four subscales: self-efficacy, goal orientation, internal valuation, and test anxiety. The self-regulated learning strategies scale has two subscales: cognitive strategy use and metacognitive strategy use. Participants rated items on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The minimum score of this questionnaire is 47, while the maximum score is 235. Higher scores indicate greater use of self-regulated learning strategies [12]. In Iran, Barat Dastjerdi and Davarpanah (2019) confirmed the reliability of this questionnaire, with a Cronbach's alpha of 0.91 [13]. Twelve faculty members assessed the content validity of the MSLQ in the present study, with a content validity index ranging from 0.9 to 1. For calculating the reliability of the MSLQ, 15 pre-hospital emergency personnel who were eligible for this study, but did not participate, completed this questionnaire. Cronbach's alpha for the total scale was 0.92 in this study.

To measure participants' motivation to learn science, the SMTSL developed by Tuan et al. (2005) was applied. This 35-item questionnaire is divided into six subscales: self-efficacy, goal orientation, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation. Participants rated items on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Five items (item 2, item 4, item 7, item 21, and item 24) were scored in reverse. Higher scores indicate greater motivation to learn. The study by Tuan et al. (2005) reported Cronbach's alpha coefficients ranging from 0.70 to 0.87 for the subscales [14]. Zare and Bakhshesh (2013) further validated the SMTSL in Iran, reporting a Cronbach's alpha of 0.83 for the total questionnaire and 0.72–0.84 for its subscales [15]. Twelve faculty members evaluated the content validity of the SMTL in the present study, with a content validity index ranging from 0.8 to 1. Similarly, for the MSLQ, Cronbach's alpha was calculated for the SMTSL. In the current study, Cronbach's alpha for the SMTSL was found to be 0.80.

Intervention

After assigning participants to the individual reflection, group reflection, and control arms, a training session was held for both the individual reflection arm and the group reflection arm. The goal of this session was to familiarize participants with the reflection process, covering its definition, importance, and phases based on the Gibbs' model of reflection. A one-hour lecture and discussion, along with practical examples and exercises, were provided to illustrate the reflection process.

Participants in the individual reflection group were instructed to use a predetermined format in a notebook to describe a selected mission. This format, based on Gibbs' model of reflection, guided participants to describe the mission, express their feelings about the mission, evaluate the positive and negative aspects of their experience, analyze what happened, identify general and specific lessons learned, and summarize areas for improvement [16]. Participants were asked to complete and provide one narrative each week for four weeks.

For participants in the group reflection arm, four weekly sessions were held on the Iranian platform called SkyRoom®. In each session, one participant narrated a daily mission, followed by a group discussion guided by the Gibbs' reflective cycle. Participants shared their

Table 1 A comparison of demographic characteristics between the three groups

Group Variable	Individual reflection (n = 18)	Group reflection (n = 18)	Control group (n = 18)	Test result
Age (Median (IQR)	33.50 (29.75- 36.00)	33.00 (27.00- 36.25)	32.00 (28.75–34.25)	Z = 1.33, P = 0.51^
Work experience (Median (IQR)	12.00 (8.50–14.00)	12.00 (6.00-14.50)	11.00(7.75–13.25)	Z = 0.41, P = 0.81^
Educational level (Associate degree/ MSc or above) [n(%)]	3(16.17)/ 15(83.3)	2(11.1)/16(88.9)	2 (11.10) /16 (88.90)	χ^2 = 0.46, P > 0.9†

^: Analyzed by the Kruskal–Wallis test

†: Analyzed by the Fisher's exact test

opinions and insights, focusing on description, feelings, evaluation, analysis, conclusion, and action planning. At the end of each session, the researcher asked the narrator to summarize key lessons learned by the participants.

No intervention was implemented for the control group. After four weeks (T1), all three groups completed the MSLQ and SMTSL. Immediately after intervention, the data was gathered by a researcher assistant.

Statistical analysis
Data were analyzed using SPSS version 23. Descriptive statistics, including mean, standard deviation, and percentage, were used to describe demographic variables and all main study variables. The normal distribution of the data was determined using Kolmogorov–Smirnov test. For between-group comparisons, we used the Kruskal–Wallis test followed by the Bonferroni adjusted Mann–Whitney test. Within-group comparisons were conducted using the Wilcoxon Signed-Rank test. The significance level for all analyses was set at $P < 0.05$.

Results
Of the 54 participants initially selected, 18 participants in each group completed the study. A comparison of demographic characteristics is presented in Table 1.

There were no significant differences in the main study variables and their dimensions among the three groups at baseline (Table 2).

Statistical analysis indicated that the group reflection intervention significantly improved all dimensions of the motivated strategies for learning questionnaire compared to baseline. The individual reflection intervention also led to significant improvements in most MSLQ subscales and dimensions, except for self-regulated learning strategies, test anxiety, and cognitive strategy use (Table 3).

Between-group comparisons showed that participants of the group reflection had higher MSLQ scores on all subscales and dimensions compared to both the individual group and the control group (Table 3).

Regarding the Students' Motivation toward Science Learning questionnaire (SMTSL), the group reflection intervention significantly improved the total score and all dimensions. The individual reflection group intervention also significantly improved the total SMTSL score and most dimensions, except for use of active learning strategies, achievement goal, and learning environment stimulation.

After intervention, between-group comparisons showed no significant differences in the SMTSL total score and its dimensions among the three groups (Table 4).

Discussion
This study aimed to compare the effects of group and individual reflection methods on self-regulation learning strategies and learning motivation among EMTs.

Group reflection was more effective than individual reflection and the control group in improving all dimensions of the Motivated Strategies for Learning Questionnaire (MSLQ). Both group and individual reflection methods were effective in increasing learning motivation, but group reflection was more preferable.

While no similar studies were found, studies whose variables were similar to the present study were used for comparison.

Aghaei's study (2022) demonstrated a significant positive correlation between reflection and self-regulated learning [6]. Pazhuman's study (2019) also showed a positive relationship between reflection and self-regulated learning among foreign language teachers [17]. While the results of these studies differ in terms of research population and design, their findings are in line with the present study.

Moradi Doliskani et al. (2021) emphasized the positive impact of group reflection on self-regulated strategies and learning motivation [18]. Khiat et al. (2022) further highlighted the role of self-regulated learning in improving learning motivation, metacognitive reflection, and overall quality of learning among postgraduate medical science students [10]. These findings align with the current study, supporting the effectiveness of reflection, particularly group reflection, in enhancing learning outcomes.

Group reflection can offer several benefits, including improved self-efficacy, reduced anxiety, and enhanced self-assessment [8]. However, Aghaei's study (2022) showed no significant relationship between reflection and subscales of motivational beliefs, including self-efficacy, internal evaluation, and test anxiety [6]. It is worth noting that decreased cognitive and self-regulation strategies can be related to increased test anxiety [19]. Self-efficacy and perceived task ease are important internal motivators [7]. The identification process within group reflection can foster internal motivation. The discrepancy between the current study and Aghaei's study may be attributed to differences in the type of study and the population.

Additionally, Aghaei's study (2022) found no significant relationship between reflection and self-regulated learning strategies (cognitive strategies, metacognitive strategies and resource management, and motivational beliefs) among full-time and virtual course students [6], which was inconsistent with the present study. It is important to pay attention to this point: self-regulated learning is a multidimensional construct that emphasizes the active role of the learner [20]. Self-regulated

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Table 2 Comparisons of main study variables and their dimensions at baseline

	T0		Z (*P* value)
	n	Median (IQR)	
1. Self-regulated learning strategies (total score)			
Individual reflection	18	170.00(148.50-181.50)	0.02 (0.85) ^
Group reflection	18	171.00(158.75–179.00)	
Control group	18	165.50(144.75–186.00)	
1.1. Motivational beliefs			
Individual reflection	18	81.00(70.50-91.25)	0.01 (0.99) ^
Group reflection	18	81.50(76.75-88.00)	
Control group	18	81.00(70.75–95.25)	
1.1. 2. Self-efficacy			
Individual reflection	18	33.00(30.00–37.00)	0.02 (0.98) ^
Group reflection	18	32.50(31.00-34.50)	
Control group	18	32.50(31.00-34.50)	
1.1.3. Goal orientation			
Individual reflection	18	15.00(12.00–16.00)	0.24 (0.88) ^
Group reflection	18	14.00 (11.75-16.00	
Control group	18	13.50(12.00–18.00)	
1.1.4. Intrinsic value			
Individual reflection	18	11.50(9.75-13.00)	0.20 (0.90) ^
Group reflection	18	11.50(9.75–13.25)	
Control group	18	11.50(10.00–14.00)	
1.1.5. Test anxiety			
Individual reflection	18	23.50(19.75-26.00)	0.01 (0.99) ^
Group reflection	18	23.50(21.00–25.00)	
Control group	18	22.00(19.75–28.00)	
1.2. Self-regulated learning strategies			
Individual reflection	18	85.50(79.25–93.25)	0.30 (0.85) ^
Group reflection	18	86.50(81.00-92.25)	
Control group	18	83.00(74.00-94.25)	
1.2.1. Cognitive strategy use			
Individual reflection	18	52.00(47.75-57.00)	0.37 (0.82) ^
Group reflection	18	51.50(49.50–58.00)	
Control group	18	51.50(46.50–55.00)	
1.2.2. Metacognitive strategy use			
Individual reflection	18	34.00(30.75-37.00)	0.39 (0.82) ^
Group reflection	18	33.50(30.75-37.00)	
Control group	18	32.00(27.00-37.25)	
2. Motivation toward science learning (total score)			
Individual reflection	18	125.50(118.00-136.50)	0.20 (0.90) ^
Group reflection	18	127.50(127.50-133.25)	
Control group	18	123.00(108.75-149.25)	
2.1. Self-efficacy			
Individual reflection	18	25.00(22.50-27.25)	0.90 (0.63) ^
Group reflection	18	24.50(21.00-26.25)	
Control group	18	26.50(20.75.30.00)	
2.2. Use of active learning strategies			
Individual reflection	18	25.50(20.50-29.25)	0.60 (0.74) ^
Group reflection	18	25.00(21.75-28.25)	
Control group	18	24.50(22.75-31.00)	
2.3. Science learning value			
Individual reflection	18	21.50(20.00-23.25)	0.63 (0.72) ^
Group reflection	18	21.00(20.00-22.25)	
Control group	18	22.00(18.75-27.00)	

Table 2 (continued)

	T0		Z (*P* value)
	n	Median (IQR)	
2.4. Performance goal			
Individual reflection	18	13.00(12.00–15.00)	0.06 (0.96) ^
Group reflection	18	13.00(12.00–16.00)	
Control group	18	13.00(12.00-16.25)	
2.5. Achievement goal			
Individual reflection	18	17.00(15.00-20.50)	1.21 (0.54) ^
Group reflection	18	18.50(16.75-21.00)	
Control group	18	19.00(15.00-24.25)	
2.6. Learning environment stimulation			
Individual reflection	18	17.00(15.00-20.50)	0.004 (0.99) ^
Group reflection	18	23.50(18.75–25.25)	
Control group	18	22.00(19.00-26.25)	

^: Analyzed using the Kruskal–Wallis test

learners use metacognitive processes to select, monitor, and evaluate task-related plans [7]. They also employ cognitive, metacognitive, and resource management strategies [20]. Group reflection facilitates self-reflection and comparison among group members, leading to the creation of a professional identity and the enhancement of internal motivation [21]. Group reflection is often used as an intervention to facilitate group functioning, but it can also affect individual learning in different ways. Some studies, such as Bolinger et al.'s (2014), suggest that group reflection may not lead to greater perceived performance improvement compared to individual reflection. Additionally, individual reflection may even lead to in-depth learning in certain contexts [22]. However, it is important to consider the potential discrepancy between perceived and real learning. While group reflection may not always lead to immediate, tangible benefits, it can foster critical thinking, emotional expression, and self-awareness, which are crucial for long-term professional development. Group learning can increase critical thinking, but it also reduce concentration and the learning quantity in some people [23]. Research supports the importance of group learning as a powerful educational facilitator, especially in contexts like team-based and problem-based learning where learning is constructed within a social and cultural context and is influenced by the social and emotional environment. Group reflection exercises allow individuals to reflect on their own behavior, leading to a more competent analysis of the learned content, implemented behaviors, and accepted roles within the group. However, group learning can decrease concentration, potentially leading to non-analytical and poor learning outcomes [21].

Collaborative learning environments, such as those that occur in group reflection sessions, lead to the development of metacognition and self-regulated learning in learners by providing opportunities for discussion and reasoning about solutions and seeking help from others. Additionally, the positive and pleasant feelings that staff gain from group discussions and learning enhance their self-efficacy. This is because many human behaviors are stimulated by mechanisms that influence self, among which self-efficacy is the most important and pervasive [24].

One significant strength of the present study is the simplicity and cost-effectiveness of this educational method. By creating active and collaborative learning and promoting long-lasting knowledge retention, this approach can improve self-regulation and learning motivation among employees. It allowed easy to document personal experiences and errors in a personal reflection notebook without fear of negative consequences, encouraged group discussion and exchange of opinions and ideas in any situation, led to a clearer understanding of one's performance, and identified areas of improvement. By learning from mistakes and preparing for future challenges, individuals can develop a sense of confidence and reduce anxiety. By incorporating reflection as a regular professional practice, emergency staff can engage in lifelong learning. This approach can be applied not only in the medical field but also in various other domains.

The limitations of this study include the following: the study focused only on emergency medical staff, limiting the generalizability of the findings to other healthcare workers. Some participants expressed concerns about potential negative consequences of disclosing errors and omissions. We tried to gain their confidence by explaining the objectives and guaranteeing the confidentiality of the data.

Conclusion

The results of this research highlight the priority of group reflection method over individual reflection in promoting self-regulated learning. Additionally, while

Table 3 Comparisons of learning strategies and their dimensions

	T0		T1		Within groups Z (P value)[T0 vs. T1]	Between groups Z (P value) [X:Y:Z]
	n	Median (IQR)	n	Median (IQR)		
1. Self-regulated learning strategies (total score)						
Individual reflection	18	170.00(148.50–181.50)	18	171.00(156.75–186.50)	1.87 (0.06) ^	17.30(< 0.001) ^^ [0.002, 0.77, 0.001]
Group reflection	18	171.00(158.75–179.00)	18	198.50(185.00–203.00)	3.72 (< 0.001) ^	
Control group	18	165.50(144.75–186.00)	18	169.50(142.00–186.75)	0.04 (0.96) ^	
1.2. Motivational beliefs						
Individual reflection	18	81.00(70.50–91.25)	18	86.00(78.75–95.25)	3.34 (0.001) ^	19.19 (0.001) ^^ [0.001, > 0.9, < 0.001]
Group reflection	18	81.50(76.75–88.00)	18	99.50(95.75–105.25)	3.72 (< 0.001) ^	
Control group	18	81.00(70.75–95.25)	18	84.50(69.50–95.50)	0.83(0.40) ^	
1.2. 1. Self-efficacy						
Individual reflection	18	33.00(30.00–37.00)	18	35.00(31.00–38.00)	2.35 (0.01) ^	17.45(< 0.001) ^^ [0.004, > 0.9, < 0.001]
Group reflection	18	32.50(31.00–34.50)	18	39.00(37.00–40.25)	3.95 (< 0.001) ^	
Control group	18	32.50(31.00–34.50)	18	34.00 (29.50–36.50)	0.59 (0.55) ^	
1.2.2. Goal orientation						
Individual reflection	18	15.00(12.00–16.00)	18	15.00(13.00–17.25)	3.07 (0.002) ^	11.85(0.003) ^^ [0.03,>0.9, 0.003]
Group reflection	18	14.00 (11.75–16.00)	18	18.50(16.00–20.50)	3.66 (< 0.001) ^	
Control group	18	13.50(12.00–18.00)	18	14.00(10.75–18.25)	0.29 (0.73) ^	
1.2.3. Intrinsic value						
Individual reflection	18	11.50(9.75–13.00)	18	12.00(10.75–14.25)	3.07(0.005) ^	14.76 (0.001) ^^ [0.002, > 0.9, 0.005]
Group reflection	18	11.50(9.75–13.25)	18	15.50 (14.00–16.25)	3.47 (< 0.001) ^	
Control group	18	11.50(10.00–14.00)	18	12.50(15.00–11.00)	1.68(0.09) ^	
1.2.4. Test anxiety						
Individual reflection	18	23.50(19.75–26.00)	18	25.00(21.75–26.25)	1.95(0.06) ^	13.71 (0.001) ^^ [0.01, >0.9, 0.002]
Group reflection	18	23.50(21.00–25.00)	18	30.25(26.00–28.00)	3.39 (0.001) ^	
Control group	18	22.00(19.75–28.00)	18	23.50(19.75–26.50)	0.17 (0.86) ^	
1.3. Self-regulated learning strategies						
Individual reflection	18	85.50(79.25–93.25)	18	86.00(75.50–95.00)	3.93 (0.69) ^	12.70(0.002) ^^ [0.02, > 0.90.50, 0.002]
Group reflection	18	86.50(81.00–92.25)	18	95.50(90.75–99.00)	3.38(0.001) ^	
Control group	18	83.00(74.00–94.25)	18	83.50(75.00–92.25)	0.30(0.76) ^	
1.3.1. Cognitive strategy use						
Individual reflection	18	52.00(47.75–57.00)	18	52.00(42.75–58.00)	0.30 (0.76) ^	7.11 (0.02) ^^ [0.02, 0.83, 0.01]
Group reflection	18	51.50(49.50–58.00)	18	56.50(53.50–59.75)	1.98 (0.04) ^	
Control group	18	51.50(46.50–55.00)	18	52.00(43.25–56.25)	0.94 (0.34) ^	
1.3.2. Meta cognitive strategy use						

both methods can increase learning motivation, group reflection appears to be more effective. Therefore, it is recommended that emergency medical service managers provide training programs that incorporate group reflection techniques. This approach can significantly benefit Pre-hospital emergency personnel by improving their self-regulated learning strategies and learning motivation. To explore the long-term impact of reflection on self-regulated learning and motivation in pre-hospital emergency settings, future research should be conducted on a larger scale and over an extended period.

Table 3 (continued)

	T0		T1		Within groups Z (*P*value)[T0 vs. T1]	Between groups Z (*P*value) [X: Y: Z]
	n	Median (IQR)	n	Median (IQR)		
Individual reflection	18	34.00(30.75-37.00)	18	34.00(32.00-37.50)	2.09 (0.03) ^	11.55 (0.003) ^^ [0.006, 0.30, 0.002]
Group reflection	18	33.50(30.75-37.00)	18	39.00(36.00-40.00)	3.62 (<0.001) ^	
Control group	18	32.00(27.00-37.25)	18	33.50(27.00-36.50)	0.91 (0.36) ^	

^: analyzed using the Wilcoxon Signed-Rank test

^^: analyzed using the Kruskal–Wallis test

[X: Y: Z]: multiple comparisons using the by Bonferroni adjusted Mann–Whitney test; X: individual reflection vs. group reflection; Y: individual reflection vs. control; Z: group reflection vs. control.

Table 4 Comparisons of motivation toward science learning and its dimensions

	T1		T2		Within groups Z(*P*value)[T1 vs. T2]	Between groups Z(*P*value)[X: Y: Z]
	n	Median (IQR)	n	Median (IQR)		
1. Motivation toward science learning (total score)						
Individual reflection	18	125.50(118.00–136.50)	18	132.50(123.75–143.25)	3.51 (< 0.001) [^]	6.47 (0.03) [^^] [0.07, 0.0.9, 0.09]
Group reflection	18	127.50(127.50–133.25)	18	149.50(134.75−157.50)	3.48 (< 0.001) [^]	
Control group	18	123.00(108.75–149.25)	18	130.00(110.25–143.00)	0.06 (> 0.9) [^]	
1.1. Self-efficacy						
Individual reflection	18	25.00(22.50–27.25)	18	28.50 (23.75–30.00)	2.33 (0.01) [^]	5.46 (0.06) [^^] --
Group reflection	18	24.50(21.00–26.25)	18	30.00 (27.25–32.25)	3.43 (0.001) [^]	
Control group	18	26.50(20.75.30.00)	18	26.50 (20.50–32.00)	1.09(0.27) [^]	
1.2. Use of active learning strategies						
Individual reflection	18	25.50(20.50–29.25)	18	27.50(24.00–29.00)	1.59 (0.11) [^]	3.99 (0.13) [^^] --
Group reflection	18	25.00(21.75–28.25)	18	29.50 (26.75–32.25)	2.84 (0.004) [^]	
Control group	18	24.50(22.75–31.00)	18	25.00(20.50-31.25)	0.31 (0.75) [^]	
1.3. Science learning value						
Individual reflection	18	21.50(20.00–23.25)	18	27.50(24.00–29.00)	2.37 (0.01) [^]	5.48 (0.05) [^^] --
Group reflection	18	21.00(20.00–22.25)	18	26.00(23.75-28.00)	3.40 (0.001) [^]	
Control group	18	22.00(18.75–27.00)	18	21.50(8.50-27.25)	0.08 (> 0.9) [^]	
1.4. Performance goal						
Individual reflection	18	13.00(12.00–15.00)	18	15.00(12.75–15.25)	1.63 (0.01) [^]	3.52 (0.17) [^^] --
Group reflection	18	13.00(12.00–16.00)	18	16.00(13.75–18.00)	3.41 (0.001) [^]	
Control group	18	13.00(12.00–16.25)	18	14.50(11.75–17.25)	1.37 (0.17) [^]	
1.5. Achievement goal						
Individual reflection	18	17.00(15.00–20.50)	18	19.00(18.00–21.00)	1.45 (0.14) [^]	3.41 (0.18) [^^] --
Group reflection	18	18.50(16.75–21.00)	18	22.00(18.75–23.00)	2.66 (0.008) [^]	
Control group	18	19.00(15.00–24.25)	18	23.00(20.00–25.50)	1.46 (0.14) [^]	
1.6. Learning environment stimulation						
Individual reflection	18	17.00(15.00–20.50)	18	22.50(20.50–24.00)	0.15 (0.87) [^]	2.24 (0.32) [^^] --
Group reflection	18	23.50(18.75–25.25)	18	24.00(21.75–27.25)	2.20 (0.02) [^]	
Control group	18	22.00(19.00–26.25)	18	23.00(20.00–25.50)	0.05 (> 0.9) [^]	

[^]: analyzed using the Wilcoxon Signed-Rank test

[^^]: analyzed using the Kruskal–Wallis test

[X: Y: Z]: multiple comparisons using the by Bonferroni adjusted Mann–Whitney test, X: individual reflection vs. group reflection; Y: individual reflection vs. control; Z: group reflection vs. control.

Declarations

Ethics declarations
This study was approved by the ethics committee of Birjand University of Medical Sciences (IR.BUMS.REC.1401.440) and adhered to the Declaration of Helsinki. The study purpose and importance were explained to participants, who met the inclusion criteria, and their informed consent was obtained. They were also assured that the data was confidential and they could withdraw from the study at any time.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Mehmood A, Rowther AA, Kobusingye O, Hyder AAJI. Assessment of pre-hospital emergency medical services in low-income settings using a health systems approach. Int J Emerg Med. 2018;11:1–10.
2. Parvaresh-Masoud M, Rahimkhanli M, Torabian H, Motamed-Jahromi M, Dehghani M, Farahmandnia HJSDME. Perspectives of Emergency Medical technicians on the Integration of Medical Science Education in Prehospital Emergency Care in Iran: a thematic analysis study. Strides Dev Med Educ. 2024;21(1):99–105.
3. Sadeghi M, Sohrabizadeh SJJIMC. Exploring Emergency Medical Technicians (EMTs) Challenges in Providing Pre-Hospital Care During COVID-19 Pandemic: A Qualitative Study. 2023.
4. Aslan R, Şahinöz S, Şahinöz TJIEN. Determination of START triage skill and knowledge levels of Prehospital Emergency Medical Staff: a cross sectional study. Int Emerg Nurs. 2021;56:101004.
5. Rowland M, Adefuye AOJAiME. Practice. An evaluation of Pre-hospital Emergency Care Personnel Knowledge about Crisis Resource Management and perspectives of educators about inclusion of Crisis Resource Management in the Pre-hospital Emergency Care Curriculum. Adv Med Educ Pract. 2022;13:849.
6. Aghaei S, Shokrpour N, Bazrafkan LJMSE. The relationship between reflectivity and self-regulated learning in MA Medical Education Students of Shiraz University in 2018 and 2019. 2022;32(5):1065–72.
7. Sandars JJMt. The use of reflection in medical education: AMEE Guide 44. Med Teach. 2009;31(8):685–95.
8. Phua GLG, Owyong JLJ, Leong ITY, Goh S, Somasundaram N, Poon EYL, et al. A systematic scoping review of group reflection in medical education. BMC Med Educ. 2024;24(1):398.
9. Ateş AAJIJT, Education D. Exploring the impact of self-regulated learning intervention on students' strategy use and performance in a design studio course. Int J Technol Des Educ. 2023;33(5):1923–57.
10. Khiat H, Vogel SJJUT, Practice L. A self-regulated learning management system: enhancing performance, motivation and reflection in learning. 2022;19(2):43–59.
11. Momennasab M, Ghanbari M, Rivaz MJB. Improving nurses' knowledge, attitude, and performance in relation to ethical codes through group reflection strategy. BMC Nurs. 2021;20:1–9.
12. Pintrich PR, De Groot EVJJ. Motivational and self-regulated learning components of classroom academic performance. J Educ Psychol. 1990;82(1):33.
13. Barat Dastjerdi N, Davarpanah SHJBJCSL. Structural equations modeling of relations between abilities of the Learning Management System to Improvement Motivational beliefs and Self-Regulation learning strategies of virtual students in University of Isfahan. Biquarterly J Cogn Strategies Learn. 2019;7(12):87–108.
14. Tuan* HL, Chin CC, Shieh SHJI. The development of a questionnaire to measure students' motivation towards science learning. Int J Sci Educ. 2005;27(6):639–54.
15. Zare H, Bakhshesh MJJol. Evaluation. A study of the reliability and validity of science learning motivation questionnaire. J Instruction Evaluation. 2013;6(24):51–66.
16. Gibbs GJFEU. Learning by doing: A guide to teaching and learning methods. 1988.
17. Pazhoman H, Sarkhosh MJIJI. The Relationship between Iranian English High School Teachers' Reflective Practices, Their Self-Regulation and Teaching Experience. 2019;12(1):995–1010.
18. Moradi Doliskani M, Yonespour Z, Poya MJNEA. The effect of flipped classroom teaching on self-regulatory learning strategies and learning motivation components in research method course among the staff of AJA research center. 2021;16(2):99–116.
19. Kim K-J, Jang HW. Changes in medical students' motivation and self-regulated learning: a preliminary study. Int J Med Educ. 2015;6:213.
20. Li J, Ye H, Tang Y, Zhou Z, Hu X. What are the effects of self-regulation phases and strategies for Chinese students? A meta-analysis of two decades research of the association between self-regulation and academic performance. Front Psychol. 2018;9:2434.
21. Rania N, Coppola I, Pinna LJFP. Reflective practices to study group dynamics: implement empowerment and understand the functioning of groups. Front Psychol. 2021;12:786754.
22. Bolinger AR, Stanton JVJSGR. The gap between perceived and actual learning from group reflection. 2014;45(5):539–67.
23. Mann K, Gordon J, MacLeod AJA. Reflection and reflective practice in health professions education: a systematic review. Adv Health Sci Educ. 2009;14:595–621.
24. Sarani A, Mousavi SH, Salahi S, Hasani F, Abdar ZE, Sheikhbardsiri HJJ, et al. Emotional intelligence and self-efficacy among deputy's administrative staff of Kerman. Univ Med Sci. 2020;9(1):105.

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