Res Dev Med Educ. 2025;14:33336
doi: 10.34172/rdme.025.33336
https://rdme.tbzmed.ac.ir

Original Article

Paper-based or electronic portfolios? A study on undergraduate medical students

Azadeh Soltanifar[1,2], Lida Jarahi[2], Majid Khadem-Rezaiyan[1,2*]

[1]Department of Community Medicine, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
[2]Medical Sciences Education Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

Article info
Article History:
Received: May 8, 2025
Revised: July 17, 2025
Accepted: July 21, 2025
epublished: August 24, 2025

Keywords:
Paper portfolio, Electronic portfolio, Medical student

Abstract

Background: A Portfolio is an excellent instrument for integrating instruction and evaluation in education. In most instances, the portfolios employed are paper-based, which presents several drawbacks. This study compares the effectiveness of paper-based and electronic portfolios at Mashhad University of Medical Sciences.

Methods: This interventional study was conducted with two parallel groups in the Department of Community Medicine, Faculty of Medicine, Mashhad University of Medical Sciences. The intervention group used an electronic portfolio for one month while the control group completed the usual paper-based portfolio. The satisfaction and final grades of medical students were compared alongside qualitative comments for the strengths and weaknesses of portfolios.

Results: Most basic characteristics were similar in the two study groups except grade point average (GPA). The final grade was 16.43 ± 1.55 in the control group, while it was 17.31 ± 0.94 in the intervention group ($P = 0.053$). The satisfaction scores were not different between the two groups (10.08 ± 4.44 in the control group and 10.93 ± 4.68 in the intervention group, $P = 0.568$). The linear regression model showed no difference between the two groups after adjusting for GPA.

Conclusion: The results indicate that although there are no substantial differences in student satisfaction or final grade between the two portfolio types, this study affirms the potential advantages of electronic portfolios and asserts that, due to the varied impacts of technology on learning experiences, the implementation of these tools necessitates consideration of the specific needs and challenges faced by students.

Introduction

In recent decades, there has been a significant shift in medical education, from traditional memorization-based approaches to competency-based, student-centered models that emphasize skill development and active learning.[1] This transition underscores the importance of innovative educational tools and assessment methodologies that foster motivation, engagement, and lifelong learning.[1]

One such tool that has gained prominence is the portfolio, a method used to document and demonstrate students' progress, competencies, and reflections over time.[2-5] The portfolio has been employed in medical education for over three decades and has proven effective in enhancing clinical skills and formative assessment.[6-8] For example, studies at various institutions, including Tabriz University of Medical Sciences, have reported that over 75% of students perceive portfolios as motivating and engaging, improving the quality of their learning experience and supporting continuous academic development.[9]

In most instances, the portfolios employed are paper-based, which presents several drawbacks, including bulkiness, lack of modifiability, illegibility of certain students' handwriting, risk of loss, and archiving complications. These issues can be resolved by utilizing an electronic version. Furthermore, digital portfolios, or electronic portfolios, have emerged as an advanced alternative, offering advantages such as ease of updating, better organization, and greater accessibility.[10] These electronic tools facilitate tracking progress, providing feedback, and supporting self-directed learning, making them increasingly popular worldwide.[11]

Despite these advantages, implementation remains limited in many contexts. In Iran, for example, there is a lack of standardized electronic portfolio models tailored for medical students. This gap signifies the need for designing and evaluating electronic portfolios suited to local educational settings.

***Corresponding author:** Majid Khadem Rezaiyan, Email: KhademRM@mums.ac.ir

The present study aims to develop and assess an electronic portfolio system for students in the Department of Community Medicine at Mashhad University of Medical Sciences. Specifically, this research compares student satisfaction and academic performance between paper-based and electronic portfolios among medical students. The findings could offer valuable insights into integrating digital portfolios into medical curricula and enhancing educational outcomes.

Methods

Study design and participants

This quasi-experimental interventional study was conducted from September to December 2023 at the Department of Community Medicine, Mashhad University of Medical Sciences. A total of 39 students from four consecutive internship courses participated in the study. Participants were non-randomly assigned based on their enrollment in existing internship courses, with two courses using the traditional paper portfolio method and two courses using the newly developed electronic portfolio system. The allocation was based on course registration, and no randomization was performed.

Sample size, setting, and duration

Using the G-power software for estimating the difference between two independent means and considering an effect size of 0.95, alpha error of 0.5, beta error of 0.2, and allocation ratio of 1:1, each group should have at least 19 participants. Since each month nearly 10-12 students are assigned to the Department of Community Medicine, the study was conducted over 4 months during the year 2023, covering the duration of the students' internship period.

The first step involved designing the electronic portfolio based on a comprehensive review of existing literature and best practices. The structure was developed using SharePoint, integrating functionalities to replicate the data fields used in the paper portfolio. Additionally, it was augmented with advanced functionalities, including multimedia attachment capabilities and dedicated sections for instructor feedback, to enhance user interaction and usability. The design process involved a panel of experts and team consensus meetings to ensure system usability and alignment with educational objectives. The features included:

- Secure login via university credentials.
- Input fields corresponding to existing paper portfolio sections.
- Options to upload images and attachments.
- A feedback section for instructors at each activity level.
- Automatic email notifications to instructors when students submit activities for review.

Training and implementation

Students received group training sessions explaining the objectives of the study, the functionalities of the electronic portfolio, and instructions on data entry and review procedures. During the internship, students recorded their weekly activities in the electronic system according to predefined lesson plans and learning objectives. After each submission, instructors reviewed the reports within two days; if the report was complete, it was approved; otherwise, feedback was provided via the system, and students had 72 hours to revise and resubmit the report. Each report received only one iteration of feedback. Students in the control group continued their routine evaluations using the standard paper portfolio and existing assessment procedures.

Data collection instruments

We used a validated student satisfaction questionnaire, adapted from Latifi et al.[12] It included 10 Likert-scale items measuring aspects such as the similarity of the topics in the training method and evaluation form with the clinical experiences encountered in the internship, creating interest and motivation for the student to participate in learning, receiving feedback from the instructor about their work, paying attention to different aspects of the internship and not its one-dimensionality, helping to find and compensate for deficiencies during the internship, creating motivation to use books and other scientific resources, paying attention to the student's progress and not the final status, the alignment of the topics in the evaluation method with the goals of the clinical internship, the fairness of the evaluation in each educational method, and satisfaction with the educational method. The responses ranged from 0 = "not satisfied" to 2 = "completely satisfied". The questionnaire's validity and reliability have been established in prior studies.[11,12]

Qualitative feedback

In addition, a qualitative survey was conducted, involving two open-ended questions to explore perceived strengths (one question) and weaknesses (one question) of the electronic portfolio system. Data from this component were analyzed via thematic content analysis, with coding performed independently by two researchers, followed by theme identification and consensus. The extracted themes about strengths and weaknesses were reported.

Data analysis

Statistical analysis was conducted using SPSS version 16. Quantitative variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. The chi-square test (or Fisher's exact test when cell counts were low) was used for categorical comparisons. Satisfaction scores were compared between groups using the Student's t-test; in case of non-normal distribution, the Mann-Whitney U test was used. To control for potential confounders such as age, gender, and grade point average (GPA), a linear regression model with the enter method was applied with satisfaction score as

the dependent variable. The 95% confidence interval was reported for the β coefficient. Moreover, the goodness of fit for this model is reported based on the R-squared value. Statistical significance was set at $P < 0.05$.

Results

Overall, 39 students, consisting of 16 and 23 participants, were included in two groups of electronic and paper portfolios, respectively. Of these, 22 were boys and 17 were girls. The average age of the participants was 25.8 ± 0.90 years. As Table 1 shows, basic characteristics, including age, gender, interest in the field of information technology, and familiarity with the portfolio method, did not have a statistically significant difference between the intervention and control groups. However, the GPA in the intervention group was significantly higher than the control group. (16.5 ± 0.6 vs. 15.5 ± 0.1, respectively, and $P = 0.002$).

There was no statistically significant difference between the groups regarding satisfaction score (mean ± standard deviation: 10.08 ± 4.44 in the control group and 10.93 ± 4.68 in the intervention group, $P = 0.568$). The student t-test shows that the final grade was 16.43 ± 1.55 in the control group, while it was 17.31 ± 0.94 in the intervention group ($P = 0.053$).

Since the GPA was different between the two groups, a multivariable linear regression model was used to control for this confounder (Table 2). After adjusting for GPA, the β coefficient for the intervention group was 2.35 ($P = 0.161$). This indicates that, holding GPA constant, there was no statistically significant difference in satisfaction scores between the intervention and control groups. The goodness of fit for this model, based on the R-squared value, was 0.096. Similarly, a multivariable linear regression model was used to predict final grade while controlling for GPA. After adjusting for the effect of GPA, the intervention group was not a predictor of final grade (β = 0.40, $P = 0.423$). The goodness of fit for this model, based on the R-squared value, was 0.176.

The most prevalent strengths for portfolios were preparing the student for a future career, preparing for teamwork, and providing a deeper and more holistic assessment of medical students. On the other hand, the most prevalent weakness of the portfolio was the low quota from the global grade, a high number of portfolio items and some redundant ones, the difficulty in entering the required data in paper or electronic portfolios, and low synchronization with some clinical tasks.

Discussion

The implementation of electronic portfolios in medical education offers several advantages, most notably enabling immediate and ongoing feedback that enhances student engagement and active learning. These portfolios facilitate self-assessment, self-regulated learning, reflection, and the development of personal skills. As effective assessment tools, they compile evidence of students' efforts, progress, and achievements across theoretical and clinical courses.[13-15] In addition to these benefits, electronic portfolios are more durable, user-friendly, accessible, and interactive, particularly suited for specific situations.[16] They allow instructors to evaluate students at various times and give feedback remotely via internet access, making the process more private and appealing. This approach also empowers students, fostering independence and shifting

Table 1. Comparison of baseline characteristics between the two study groups

		Paper portfolio (n = 23)	Electronic portfolio (n = 16)	*P* value
Gender	Male	12 (52.2%)	5 (31.3%)	0.325
	Female	11 (47.8%)	11 (68.8%)	
Familiarity with the Portfolio method	Yes	6 (26.1%)	1 (6.3%)	0.206
	No	17 (73.9%)	15 (93.8%)	
Age (y)		25.26 ± 1.05	25.31 ± 0.87	0.873
GPA		15.57 ± 1.03	16.56 ± 0.62	0.002
Interest in information technology		5.96 ± 2.73	5.81 ± 2.50	0.868

GPA, Grade point average.
Data represented as frequency (percentage) or mean ± standard deviation for qualitative and quantitative variables, respectively.

Table 2. The findings of the multivariable linear regression model for the prediction of satisfaction and final grade

		Beta coefficient	95% Confidence interval	*P* value
Predicting satisfaction score ($R^2 = 0.096$)	Constant	31.17	6.91 to 55.44	0.013
	Group (R = Control)	2.35	-0.97 to 5.68	0.161
	GPA	-1.50	-3.14 to 0.13	0.071
Predicting final grade ($R^2 = 0.176$)	Constant	9.14	1.80 to 16.49	0.016
	Group (R = Control)	0.40	-0.60 to 1.41	0.423
	GPA	0.44	-0.05 to 0.94	0.080

GPA, Grade point average.

from teacher-centered to student-centered learning strategies.[17-22]

Furthermore, electronic portfolios support equitable training and assessment by enabling personalized feedback and performance-based evaluations.[23] Research by Mahmoudian and Meraji highlights that these tools enhance efficiency and transparency, allowing faculty to monitor students' progress with greater accuracy and speed.[2] They promote accountability, critical thinking, self-awareness, and creativity, leading to deeper understanding and problem-solving skills.[24] However, despite these advantages, our findings indicate no significant difference in student satisfaction or final grades between paper-based and electronic portfolios. These results contrast with prior studies, such as those by Dolatshahi et al, which reported higher satisfaction levels with electronic portfolios, primarily due to improved access and quicker document updates.[25] Similar findings have been documented in other studies.[12,26,27,28]

Recent research emphasizes that various factors influence student satisfaction with electronic portfolios. A systematic review identified barriers such as unfamiliarity with new technologies, lack of confidence in software, reliance on paper portfolios, and concerns over receiving feedback.[16] Additional obstacles include increased workload, the need for technological skills, and infrastructural issues like unreliable internet connectivity—factors that often limit adoption and effective use.[29-32] In our study, students' reliance on personal mobile devices to access portfolios in clinical settings contributed to lower satisfaction. While convenience is an advantage, technical limitations, insufficient technical support, and a lack of resources further hinder usability.[31-33] Trust concerns regarding digital privacy and the perception that paper portfolios are more trustworthy also reduce acceptance of electronic alternatives.[34,35] Psychological factors such as feelings of security, learning habits, and technological proficiency significantly impact satisfaction with e-learning tools.[36] Naderifar et al asserted in their study that e-learning cannot be effectively utilized unless individuals are sufficiently trained, prepared, or apprehensive about it.[36] Nevertheless, concerning the improvement of student learning, the findings of the current study align with other prior studies.[2,9,33,37,38,39] Overall, consistent with prior research, this study emphasizes the importance of improving infrastructural and technological support to enhance student satisfaction. Recognizing students' diverse needs and challenges is essential for developing educational programs that meet both student and faculty expectations across multiple domains.

This study is not without limitations. One is the sample size, which may affect the generalizability of the findings. The second is that working with electronic portfolios was difficult for some students in terms of low internet speed or even the unavailability of a computer for entering data, which may be an explanation for the low satisfaction with electronic portfolios. Nevertheless, by examining various aspects of students' experiences with both electronic and paper portfolios, this research provides valuable insights into their needs and concerns, ultimately contributing to the improvement of medical education. We also tried to avoid contamination between the two groups by starting the study in the control group (two months) and then recruiting the intervention group (two months).

The findings can guide academics and policymakers in refining and advancing educational strategies through electronic portfolios while addressing current barriers. Despite some limitations, this study represents progress in understanding the application of electronic portfolios in community-based and health-related medical education and offers a foundation for future research in this area.

Conclusion

This research assessed medical students' satisfaction and academic performance with electronic portfolios in comparison to paper portfolios. The results indicate that although there are no substantial differences in student satisfaction or final grade between the two portfolio types, this study affirms the potential advantages of electronic portfolios and asserts that, due to the varied impacts of technology on learning experiences, the implementation of these tools necessitates consideration of the specific needs and challenges faced by students. Considering the significance of electronic portfolios in enhancing the learning and assessment process, it is essential to provide adequate preparation that encompasses training to elevate the awareness and proficiency of both students and instructors in utilizing this instrument. Moreover, establishing the requisite technical support and infrastructure can enhance student satisfaction and engagement. Consequently, it is determined that enhancements are essential to satisfy user requirements and to perpetually refine the utilization of e-portfolios, so improving both the structure and content to optimize learning outcomes and student satisfaction. Ultimately, ongoing study in this domain may enhance understanding of the impact of various portfolio types on the educational and professional advancement of medical students, thereby informing future policy and planning efforts.

Acknowledgments

The authors appreciate the kind support of the Department of Community Medicine at Mashhad University of Medical Sciences, especially Mr. Mohammad Akbari Zahmati and Ms. Maryam Noori, for performing this study. Also, the support of the Medical Sciences Education Research Center in preparing this manuscript is highly appreciated.

Authors' Contribution

Conceptualization: Majid Khadem-Rezaiyan, Lida Jarahi.
Data curation: Azadeh Soltanifar, Lida Jarahi.
Investigation: Azadeh Soltanifar, Lida Jarahi, Majid Khadem-Rezaiyan.

Methodology: Majid Khadem-Rezaiyan, Lida Jarahi.
Project administration: Majid Khadem-Rezaiyan.
Resources: Majid Khadem-Rezaiyan.
Software: Azadeh Soltanifar, Lida Jarahi, Majid Khadem-Rezaiyan.
Supervision: Majid Khadem-Rezaiyan.
Writing–original draft: Azadeh Soltanifar, Majid Khadem-Rezaiyan.
Writing–review & editing: Azadeh Soltanifar, Lida Jarahi, Majid Khadem-Rezaiyan.

Competing Interests

The authors declare no conflict of interest.

Ethical Approval

The study was approved by the Ethics Research Committee of Mashhad University of Medical Sciences (approval code: IR.MUMS.REC.1401.396).

Funding

This study was performed with the support of the Vice Chancellor for Research at Mashhad University of Medical Sciences (project code: 4011122).

References

1. Driessen E, van Tartwijk J, van der Vleuten C, Wass V. Portfolios in medical education: why do they meet with mixed success? A systematic review. Med Educ. 2007;41(12):1224-33. doi: 10.1111/j.1365-2923.2007.02944.x.
2. Mahmoudian S, Meraji M. Portfolio and its role in medical education. Horiz Med Educ Dev. 2016;7(1):38-44. doi: 10.22038/hmed.2016.13605. [Persian].
3. Rajabpour M, Karimi Moonaghi H. Effective tools and methods for evaluating the clinical performance of medical sciences students: a systematic review. Horiz Med Educ Dev. 2024;15(2):69-81. doi: 10.22038/hmed.2024.73743.1283. [Persian].
4. Keshmiri F, Heydari AS. Electronic evaluation methods: a scoping review. Horiz Med Educ Dev. 2022;13(4):98-85. doi: 10.22038/hmed.2021.58687.1176. [Persian].
5. Mastour H. Formative assessment and effective feedback in medical education. Horiz Med Educ Dev. 2020;11(3):121-01. doi: 10.22038/hmed.2020.52618.1093. [Persian].
6. Negahban Jouzan N, Karimi Moonaghi H, Poorzand H, Khajedaluee M. Exploring the methods of assessment of general medical students. Horiz Med Educ Dev. 2025;16(3):119-29. doi: 10.22038/hmed.2024.66957.1304. [Persian].
7. Hekmatpou D. Effect of portfolio-based evaluation on accuracy of clinical evaluation of nursing students during internship in Arak University of Medical Sciences Iran. Stride Dev Med Educ. 2013;10(1):60-9. [Persian].
8. Khaw C, Raw L, Tonkin A, Kildea H. Evaluation of student-prepared portfolio of guidelines in undergraduate clinical skills using a mixed methods study. Int J Med Educ. 2012;3:183-9. doi: 10.5116/ijme.5052.e985.
9. Fata L, Hazrati H, Mohammadzadeh M, Habibi H. The effect of portfolio on motivation and academic achievement of students of Tabriz University of Medical Sciences. Mil Caring Sci. 2017;4(4):288-94. doi: 10.29252/mcs.4.4.288. [Persian].
10. Zaraii Zavaraki E, Rezaei E. The impact of using ePortfolio on attitude, motivation and academic achievement of students in Khajeh Nasirddin Toosi university's e-learning center. Quarterly of Educational Measurement. 2011;2(5):1-36. [Persian].
11. Ahmady S, Asayesh H, Aghaali M, Safaeipour R. A comparison of the effect of clinical evaluation by two methods of electronic portfolio and conventional on the level of students' satisfaction. Qom Univ Med Sci J. 2016;9(12):41-9. [Persian].
12. Latifi M, Shaban M, Nikbakht Nasrabadi A, Mehran A, Parsa Yekta Z. Comparison of the effect of clinical evaluation by two methods: portfolio and popular, on satisfaction of nurse students. Iran J Nurs Res. 2011;6(21):15-28. [Persian].
13. Alhomod S, Shafi MM. Success factors of e-learning projects: a technical perspective. Turkish Online J Educ Technol. 2013;12(2):247-53.
14. Aydın CH, Tasci D. Measuring readiness for e-learning: reflections from an emerging country. J Educ Technol Soc. 2005;8(4):244-57.
15. Cidral WA, Oliveira T, Di Felice M, Aparicio M. E-learning success determinants: Brazilian empirical study. Comput Educ. 2018;122:273-90. doi: 10.1016/j.compedu.2017.12.001.
16. Tan R, Qi Ting JJ, Zhihao Hong D, Sing Lim AJ, Ong YT, Pisupati A, et al. Medical student portfolios: a systematic scoping review. J Med Educ Curric Dev. 2022;9:23821205221076022. doi: 10.1177/23821205221076022.
17. Hawks SJ. The use of electronic portfolios in nurse anesthesia education and practice. AANA J. 2012;80(2):89-93.
18. Green J, Wyllie A, Jackson D. Electronic portfolios in nursing education: a review of the literature. Nurse Educ Pract. 2014;14(1):4-8. doi: 10.1016/j.nepr.2013.08.011.
19. O'Keeffe M, Donnelly R. Exploration of ePortfolios for adding value and deepening student learning in contemporary higher education. International Journal of ePortfolio. 2013;3(1):1-11.
20. Driessen EW, Muijtjens AM, van Tartwijk J, van der Vleuten CP. Web- or paper-based portfolios: is there a difference? Med Educ. 2007;41(11):1067-73. doi: 10.1111/j.1365-2923.2007.02859.x.
21. Byszewski A, Fraser A, Lochnan H. East meets West: shadow coaching to support online reflective practice. Perspect Med Educ. 2018;7(6):412-6. doi: 10.1007/s40037-018-0476-z.
22. Fauzi I, Khusuma IH. Teachers' elementary school in online learning of COVID-19 pandemic conditions. J Iqra K Ilmu Pen. 2020;5(1):58-70. doi: 10.25217/ji.v5i1.914.
23. Huber SG, Helm C. COVID-19 and schooling: evaluation, assessment and accountability in times of crises-reacting quickly to explore key issues for policy, practice and research with the school barometer. Educ Assess Eval Account. 2020;32(2):237-70. doi: 10.1007/s11092-020-09322-y.
24. Tasi Shamsabadi M, Taghvaei Yazdi M, Niaz Azari K. The effect of electronic folder work on the thinking and mental health of medical university assistants. Razi J Med Sci. 2023;30(1):167-78. [Persian].
25. Dolatshahi M, Sohrabi S, Kazemi N, Mahmoudi S. The effect of portfolio on nursing students' learning and satisfaction from clinical evaluation. J Med Educ. 2019;18(4):211-8. doi: 10.22037/jme.v18i4.27799.
26. Bahreini M, Shahamat S, Moattari M, Akaberian S, Sharifi S, Yazdankhah Fard M. Development of reflective skills among nurses through portfolio: a qualitative study. Iran J Med Educ. 2012;12(2):120-30. [Persian].
27. Bahreini M, Ahmadi F, Shahamat S, Behzadi S. The impact of professional portfolio on nurses' clinical competence. Stride Dev Med Educ. 2012;8(2):107-14. [Persian].
28. Khound M, Das BK, Kaushik JS. Development and validation of ePortfolio for undergraduate medical students in pediatrics. Indian Pediatr. 2024;61(8):740-4.
29. Elango S, Jutti RC, Lee LK. Portfolio as a learning tool: students' perspective. Ann Acad Med Singap. 2005;34(8):511-4.
30. Wright VH, Stallworth BJ, Ray B. Challenges of electronic portfolios: student perceptions and experiences. J Technol Teach Educ. 2002;10(1):49-61.
31. Arntfield S, Parlett B, Meston CN, Apramian T, Lingard L. A model of engagement in reflective writing-based portfolios: interactions between points of vulnerability and

acts of adaptability. Med Teach. 2016;38(2):196-205. doi: 10.3109/0142159x.2015.1009426.
32. Chertoff J, Wright A, Novak M, Fantone J, Fleming A, Ahmed T, et al. Status of portfolios in undergraduate medical education in the LCME accredited US medical school. Med Teach. 2016;38(9):886-96. doi: 10.3109/0142159x.2015.1114595.
33. Vance GH, Burford B, Shapiro E, Price R. Longitudinal evaluation of a pilot ePortfolio-based supervision programme for final year medical students: views of students, supervisors and new graduates. BMC Med Educ. 2017;17(1):141. doi: 10.1186/s12909-017-0981-5.
34. Avila J, Sostmann K, Breckwoldt J, Peters H. Evaluation of the free, open source software WordPress as electronic portfolio system in undergraduate medical education. BMC Med Educ. 2016;16:157. doi: 10.1186/s12909-016-0678-1.
35. Franco R, Ament Giuliani Franco C, de Carvalho Filho MA, Severo M, Amelia Ferreira M. Use of portfolios in teaching communication skills and professionalism for Portuguese-speaking medical students. Int J Med Educ. 2020;11:37-46. doi: 10.5116/ijme.5e2a.fa68.
36. Naderifar M, Ghaljaei F, Jalalodini A, Rezaie N, Salar AR. Challenges of e-learning in medical sciences: a review article. J Med Educ Dev. 2016;9(23):102-11. [Persian].
37. Ahmadi A, Alian Nejad MR. The effect of ePortfolio on learning of emergency medical students in pharmacology courses. Education Strategies in Medical Sciences. 2017;10(1):15-22. [Persian].
38. van Schaik S, Plant J, O'Sullivan P. Promoting self-directed learning through portfolios in undergraduate medical education: the mentors' perspective. Med Teach. 2013;35(2):139-44. doi: 10.3109/0142159x.2012.733832.
39. Rahimi Anbarkeh F, Mahdavifard H, Baradaran R, Shikhi A, Etemadian P, Nouri Chenarbo M, et al. Effect of mentoring and portfolio on the scores of musculoskeletal anatomy of medical students at Neyshabur University of Medical Sciences. Clin Exc. 2024;14(1):24-33. [Persian].