Psychological effects of project-based learning in participants receiving clinical oncology teaching
A protocol of systematic review of randomized controlled trials

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Abstract
Background: This study will assess the effects of the project-based learning (PBL) for participants undergoing clinical oncology teaching (COT).

Methods: A systematic and comprehensive literature records will be identified from the electronic databases of PUBMED, EMBASE, Cochrane Library, Web of Science, Springer, Chinese Biomedical Literature Database, and China National Knowledge Infrastructure. All electronic databases will be searched from their inceptions up to the present. Any relevant randomized controlled trials on the effects of PBL in participants receiving COT will be considered for inclusion. Study quality will be assessed using the Cochrane risk of bias tool. RevMan 5.3 software will be utilized for statistical analysis.

Results: This study will assess the effects of PBL in participants receiving COT through assessing the primary outcomes of psychological disorders, student satisfaction, and student feedback, and secondary outcomes of examination scores, excellence rates, course examination pass rates, and clinical knowledge or skills.

Conclusion: The findings of this study will summarize the latest evidence on the effects of PBL in participants receiving COT.

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Abbreviations: CIs = confidence intervals, COT = clinical oncology teaching, PBL = project-based learning, RCTs = randomized controlled trial.

Keywords: effects, oncology medicine, project-based learning, randomized controlled trial

1. Introduction
Project-based learning (PBL) motivates participants to connect with knowledge and practical research experience, especially for the participants receiving clinical oncology teaching (COT).[1–5]

It has been reported that such method can help against the dissatisfaction with the traditional method of lecture-based learning.[6–11] In addition, it also involves acquiring a deeper knowledge, as well as other skills, such as teamwork, cooperation, and make decisions.[12–20] Previous studies have reported that PBL can significantly benefit for participants undergoing COT.[21–32] However, its results are still inconsistent. Furthermore, no study has specifically focused on this issue. Therefore, this study will systematically and comprehensively assess the effect of PBL in participants receiving COT.

2. Methods
2.1. Study registration
This study has been funded through a protocol registry in the PROSPERO with CRD42019150433. It follows the Cochrane Handbook for Systematic Reviews of Interventions and the preferred reporting items for systematic reviews and meta-analysis protocol statement guidelines.[33]

2.2. Eligibility criteria for included studies
2.2.1. Study types. We will include randomized controlled trials (RCTs) that assess the effects of PBL in participants receiving COT. However, we will exclude non-RCTs.

2.2.2. Participant types. All college or university students who receive COT will be included with no restrictions of country, race, and sex.

2.2.3. Intervention types. In the experimental group, all participants must receive PBL.
In the control group, all participants can receive any teaching methods, except the PBL.

2.2.4. Outcome types. The primary outcomes are psychological disorders, as measured by any psychological assessment scales; student satisfaction, as measured by any relevant surveys or scores; and student feedback, as assessed by any student feedback Questionnaires.

The secondary outcomes consist of examination scores, excellence rates, course examination pass rates, and clinical knowledge or skills, as measured using any instruments.

2.3. Search strategy

We will systematically and comprehensively search the following electronic databases of PUBMED, EMBASE, Cochrane Library, Web of Science, Springer, Chinese Biomedical Literature Database, and China National Knowledge Infrastructure. We will search all electronic databases without limitations of language and publication status from their inceptions up to the present. The following search terms will be used: problem-based learning, PBL, internal medicine, cancer, education, randomized controlled trials, blind, concealment, control, and comparator. Any relevant studies on the effects of PBL in COT will be included. We will present detailed search strategy of PUBMED in Table 1. We will adapt similar search strategy for other electronic databases. We will also search for conference proceedings, and reference lists of related reviews.

2.4. Data collection

2.4.1. Study selection. Two independent authors will identify and review relevant studies based on the previous defined eligible criteria. Any disagreements regarding the study selection between 2 authors will be solved by a third author involved. First, they will check titles and abstracts for all searched literatures and all irrelevant and duplicated studies will be excluded. Then, we will read full-texts of all remaining studies to further judge if they meet all inclusion criteria. We will record all excluded studies with reasons. We will show the process of study selection in the flowchart.

2.4.2. Data extraction. Two independent authors will carry out data extraction using standard designed data extraction sheet. A third author will be invited to solve any disagreements occurred between 2 authors. The extracted information is as follows: title, first author, time of publication, location, course name, study setting, participant characteristics, sample, study methods, intervention details, controls, outcomes, and other associated information. If any insufficient or missing information occurs, we will contact original authors to request it.

2.5. Risk of bias assessment

Two authors will independently evaluate the risk of bias assessment for each included study using the Cochrane Risk of Bias Tool. We will assess it on 7 levels, and each one is divided as low, unclear, and high risk of bias. If some different opinions exist between 2 authors, a third author will help to settle down them by discussion.

2.6. Statistical analysis

We will use RevMan 5.3 software for statistical analysis. We will calculate continuous data with mean difference or standardized mean difference and 95% confidence intervals (CIs), and will express dichotomous data as risk ratio and 95% CIs based on the availability of data from included studies. We will use $I^2$ test to check heterogeneity among included studies. $I^2 \leq 50\%$ means low heterogeneity, while $I^2 > 50\%$ means high heterogeneity. If low heterogeneity is identified among studies, we will use a fixed-effect model to pool the data. Meanwhile, we will plan to conduct meta-analysis if more than 2 studies on the same interventions and outcomes are included. On the other hand, if high heterogeneity is found, we will use a random-effect model to synthesize the data. At the same time, we will perform subgroup analysis and meta-regression test to check any possible factors that may result in such high heterogeneity among included studies.

2.7. Additional analysis

We will perform subgroup analysis based on the different interventions, study quality, and outcomes. In addition, we will also carry out sensitivity analysis to check the stability and robustness of pooled outcomes by removing studies with high risk of bias.

2.8. Reporting bias

If it is possible, we will also check the reporting bias using the funnel plot when more than 10 eligible RCTs enter in this study.

2.9. Ethics and dissemination

This study will not need ethic approval, because all data is collected from the published studies. Its results are expected to be published at a peer-reviewed journal.
3. Discussion

The PBL is one of the most common educational innovations developed against the dissatisfaction with the traditional education method. Recently, it has been widely utilized for the participants receiving COT. Up to now, a variety of studies have explored the effects of PBL compared with other education methods with inconclusive or inconsistent results. Furthermore, no systematic review has been addressed to investigate this effect. Thus, this study will assess the effect of PBL on the participants receiving COT. The results of this study will provide helpful evidence for clinical teaching education and future studies.

Author contributions

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References

[1] Sinclair M, Brown G. Project-based learning. NT Learn Curve 1998; 2:4–5.
[2] Bell S. Project based learning for the 21st century; skills for the future. Clearing House 2010;83:39–43.
[3] Blumenfeld PC, Soloway E, Marx RW, et al. Motivating project based learning: sustaining the doing, supporting the doing. Educ Psychol 1991;26:369–98.
[4] Winn S. Learning by doing: teaching research methods through student participation in a commissioned project. Stud High Educ 1995;20:203–14.
[5] Martinich JA, Solarz SL, Lyons JR. Preparing students for conservation careers through project-based learning. Conserv Biol 2006;20:1579–83.
[6] Cheng RW, Lam SF, Chan JC. When high achievers and low achievers work in the same group: the roles of group heterogeneity and processes in project-based learning. Br J Educ Psychol 2008;78:203–21.
[7] Wessel C, Spreckelsen C. Continued multidisciplinary project-based learning- implementation in health informatics. Methods Inf Med 2009;48:558–63.
[8] Krishnan S. Project-based learning with international collaboration for training biomedical engineers. Conf Proc IEEE Eng Med Biol Soc 2011;2011:6518–21.
[9] Robinson JK. Project-based learning: improving student engagement and performance in the laboratory. Anal Bioanal Chem 2013;405:7–13.
[10] Dehdash A, Mehrizadeh S, Kashani MM. Incorporation of project-based learning into an occupational health course. J Occup Health 2013;55:125–31.
[11] Krishnan S. Promoting interdisciplinary project-based learning to build the skill sets for research and development of medical devices in academia. Conf Proc IEEE Eng Med Biol Soc 2013;2013:3142–2.
[12] Wu TT. The use of a mobile assistant learning system for health education based on project-based learning. Comput Inform Nurs 2014;32:497–503.
[13] Habok A, Nagy J. In-service teachers’ perceptions of project-based learning. Springerplus 2016;5:83.
[14] Ogilvie JM, Ribbens E. Professor Eric can’t see: a project-based learning case for neurobiology students. J Undergrad Neurosci Educ 2016;15:C4–6.
[15] Lemons ML. Locate the lesion: a project-based learning case that stimulates comprehension and application of neuroanatomy. J Undergrad Neurosci Educ 2017;15:C7–10.
[16] Emery LR, Morgan SL. The application of project-based learning in bioinformatics training. PLoS Comput Biol 2017;13:e1005620.
[17] Tiwari R, Arya RK, Bansal M. Motivating students for project-based learning for application of research methodology skills. Int J Appl Basic Med Res 2017;7(Suppl 1):S4–7.
[18] Costa-Silva D, Cortes JA, Bachinski RF, et al. Teaching cell biology to dental students with a project-based learning approach. J Dent Educ 2018;82:322–31.
[19] Mateo E, Serrallano E. Project-based learning methodology in the area of microbiology applied to undergraduate medical research. FEMS Microbiol Lett 2018;365:1–7.
[20] Benis A. Healthcare informatics project-based learning: an example of a technology management graduation project focusing on veterinary medicine. Stud Health Technol Inform 2018;255:267–71.
[21] Zeng FY, Zhu YH, Zhang HL. Application of PBL teaching method in clinical practice teaching of oncology department. Xinjiang J Tradit Chin Med 2018;3640–1.
[22] Fan F. Application and thinking of PBL teaching method in clinical teaching of oncology department. Heilongjiang Med 2017;30:997–8.
[23] Guo B, Yang Z, Tang DY, et al. Application of PBL teaching mode in clinical teaching of oncology department. Chin J Library Inf Sci 2017;41:56–8.
[24] Dong XM, Zheng Z, Zhang J. Application of evidence-based medicine combined with PBL mode in clinical teaching of oncology department. World Med Inf Digg 2017;17:203–5.
[25] Wang YL, Li DW, Xie TH, et al. Application analysis of PBL teaching method in clinical teaching of tumor internal medicine. China Health Ind 2017;14:83–4.
[26] Ling GQ. Discussion on clinical teaching methods of tumor internal medicine. Harbin Med J 2013;33:462–3.
[27] Wang MT, Li X. A review of the application of PBL in clinical practice of oncology. J Chengdu Med Coll 2013;8:111–2.
[28] Wang CX. Application and discussion of PBL teaching method in clinical teaching of cancer internal medicine. Jilin Med J 2011;32:1661–2.
[29] Cao BW, Zhao ZH, Wang W, et al. Application and discussion of PBL teaching mode in clinical teaching of cancer internal medicine. J Clin Exp Med 2010;9:794–5.
[30] Liu F, Pang D, Zhang GQ. Application of PBL teaching method in clinical practice teaching of oncology department. Chin Foreign Med Care 2010;29:133.
[31] Xie L, Shen LD, Li K. Application of PBL teaching method in clinical practice teaching of oncology department. Med Educ Explor 2009;3:270–1.
[32] Liang QL, Pan DC, Zhang Y, et al. Application of PBL teaching method in clinical practice teaching of oncology department. J Shanxi Med Univ 2008;5:599–602.
[33] Moher D, Shamseer L, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Syst Rev 2015;4:1.
[34] Sutton AJ, Duval SJ, Tweedie RL, et al. Empirical assessment of effect of publication bias on meta-analyses. BMJ 2000;320:1574–7.