Effects of problem-based learning instructional intervention on critical thinking in higher education: A meta-analysis

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Abstract

In recent years, the debate has continued among researchers and instructors regarding the influence of Problem-Based Learning (PBL) on the effectiveness of instructional intervention for Critical Thinking (CT) in higher education. This study, conducting a meta-analysis by synthesizing 50 relevant empirical studies from 2000 to 2021 with 5,210 participants and 58 effect sizes, aims to present potential factors (i.e., sample size, sample type, instruction type, gender, maturity, instrument, nationality, discipline, treatment duration, and group size) that may influence the effectiveness of the cultivation of CT skills and disposition on the basis of PBL. No evident publication bias was found (Egger's bias = 1.21, \( p > 0.05 \)). From the general perspective, the results demonstrate the high level of influence of PBL (Standardized Mean Difference [SMD] = 0.640, \( p < 0.001 \)) on CT with heterogeneity (\( I^2 = 82.9\% \)) due to the adopted instruments, mixed methods, and target outcomes, and no difference was observed between influence on CT skills and disposition. Students' maturity, nationality, sample type, instruction type, and group size are influencing factors of overall CT. The effects of intervention for seniors, western students, randomized samples, online instruction, and groups with less than six members are better, whereas short-term intervention is ineffective. For CT skills, the treatments for juniors and groups with less than six members are ineffective, and sample type and instruction type are not influencing factors. However, the effect sizes of big sample sizes, seniors, other kinds of instruments, western students, Sciences as a discipline, more than ten members in a group, and long-term intervention are stronger. For CT disposition, sample type, instruction type, discipline, and intervention duration are influencing factors, in which randomized samples, online instruction, students in Medicine, and medium-term intervention exerted a stronger effect than the other factors. In conclusion, although PBL is overall effective for promoting the acquisition of CT (skills and disposition), additional studies are also required to explore the effectiveness and influencing factors in other contexts, such as various learning or teaching strategies, environments, and scaffoldings, and scenario-problem-based tasks instead of only curriculum-based ones. These factors should also be considered to promote CT skills and disposition among undergraduates.
