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The Influence of Computational Thinking Skills, Critical Thinking Skills, and Collaborative Thinking Skills on the Learning Outcomes of Robotics Competence of Electrical Engineering Education Students

Fendi Achmad[1*], Agus Wiyono[1], M. Syariffuddien Z[1], Nur Kholis[1], Ali Nur Fathoni[1], Inaya Retno Putri[1], Daeng Rahmatullah[1], Yuli Sutoto Nugroho[2]
[1] Universitas Negeri Surabaya, Surabaya, Indonesia
[2] Queen Mary University of London, London, England

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ABSTRACT
Objective: This study aims to examine the influence of computational thinking skills, critical thinking skills, and collaborative thinking skills on the learning outcomes of robotics competencies of Electrical Engineering Education Students. **Method:** The sample in this study was 150 respondents, all of whom were students of the Electrical Engineering Education Study Program at Universitas Negeri Surabaya. The research data were obtained from filling out the questionnaire and analyzed quantitatively using the SEM PLS analysis technique with the help of the SmartPLS program. **Results:** This study shows that (1) Critical thinking skills have a positive effect on the educational robotics-based learning system, (2) computational thinking skills have a positive effect on the educational robotics-based learning system, (3) collaborative skills have a positive effect on the educational robotics-based learning system, (4) critical thinking skills have a positive effect on learning outcomes, (5) Computational Thinking Skills have a positive effect on learning outcomes, (6) Collaboration Skills have a positive effect on learning outcomes, (7) educational robotics-based learning systems have a positive effect on learning outcomes. **Novelty:** Educational robotics-based learning systems can be an ideal platform for developing computational, critical, and collaborative thinking skills among students. The use of robots as interactive and direct learning media through experiments and problem solving. This can help better understand technical concepts and increase confidence in facing complex challenges in the increasingly connected and rapidly changing real world.

INTRODUCTION

The topic of using robotics to support various needs has become commonplace over the past decade. In particular, using robotics in educational contexts has become the most researched topic (Chaidi et al., 2021; Conde et al., 2021; Schina et al., 2021) where most of the robots that have been tested in previous studies involve the use of the latest user interfaces and humanoid robots that attract users' attention and facilitate social interaction between the robot and the user.

Several studies have concluded that robot behavior leaves a strong impression on users. Robot movement and human body expression can provide strong motivation that influences the user's decision-making process. Compared to public reactions to demonstrations of educational robotic kits with demonstrations of educational robotic kits through computer animation and simulation.The results Showed that demonstrations of educational robotic kits resulted in increased public reactions. Thus, robots are expected to be useful as demonstration tools (kits) in various

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