Developing Science-Technology-Engineering- Mathematics (STEM)-Based Workbook to Enhance Secondary Students' STEM Competencies on Lever System in Human Body

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ABSTRACT

This research investigated the development STEM-based workbook in enhancing students' STEM competencies in terms of knowledge understanding, problem solving skill, innovative ability, and responsibility. The research methodology is R&D from Borg & Gall with stages: collection of research information, planning, create preliminary product, preliminary field testing, revision, main field implementation, and final revision. To check its effectiveness it was tried on 26 students that applied engineering design processes, mathematics, and science knowledge to design and create an egg cracker. The result showed that STEM-based workbook on lever system in human body is effective to improve students' STEM competencies, it can be proven by students' result on their knowledge understanding improvement which resulted normalized gain (<g>) score 0.41, students' problem solving skill has also improved where it obtained <g> as much as 0.45 and both are categorized as medium improvement. Innovative abilities also indicated an improvement, the workbook analysis obtained a higher score which means students can be more innovative after finishing their workbook. Students' responsibility is keep improving day by day, students' effort gain the highest score it means that students become more responsible after implementation of STEM-based workbook. The final structure of STEM-based workbook are, it shall have basic concept materials, exploring cases, define problem, propose solution, design solution, construct product, test product, re-design, and reflection. All of the results are supported with the response of students towards STEM-based workbook implementation which showed positive response in all indicators.

Key words: STEM-based workbook, STEM competencies, lever system.