

# **Development Of Physics E-Comic Momentum And Impulse Material Using Flipped Classroom Learning Method To Improve Student's Mathematical Representation And Critical Thinking**

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## **ABSTRACT**

Rapid technological advances have made it easier for students to study flexibly. E-comic has been proven as an effective learning medium at various levels of education. The purpose of this research is to produce appropriate learning media for momentum and impulse material. In addition, this study also measures the effectiveness of using e-comics in physics learning, and analyzes students' abilities in mathematical representation and critical thinking. This development research uses the ADDIE model with five stages. The research instruments included product feasibility assessments by the validator, student response questionnaires on the use of e-comics using the flipped classroom method, as well as tests of mathematical representation abilities and critical thinking. The research design involved a pretest-posttest control group with three comparison classes using teaching media. The research was conducted in class X MIPA SMA N Kalasan in the 2022/2023 academic year. The research subjects included class X MIPA students who were randomly selected using the cluster sampling technique. Data analysis begins by examining the feasibility of media, lesson plans and test and non-test instruments such as questionnaires, observation sheets, and interviews. Instrument validation was carried out with V Aiken and quest software. The media hypothesis and effectiveness were analyzed using SPSS, while the student's ability profile was analyzed using the output quest. The results of the study show that the physics e-comic developed is feasible for use in learning momentum and impulse. The Manova test shows that the use of e-comic significantly improves students' mathematical representation abilities and critical thinking, with an effectiveness of 84%. Student ability profiles ranged between moderate and low on the topic of momentum and impulse.

**Kata Kunci:** *Critical Thinking, E-Comic, Flipped Classroom, Instagram, Mathematical Representation*