
PHYSICS DISCIPLINE WORKSHOP: DESIGNING DYNAMIC FORMATIVE ASSESSMENTS WITH DIGITAL TOOLS

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KEYWORDS: Formative Assessment, Automated Feedback, Random variations, Quizzes

SUBTHEME: Technology Enhanced Learning

In this workshop, we will explore technology-assisted approaches to formative assessment design. We'll begin by illustrating the possibilities enabled by using a Computer Algebra System (CAS), followed by a broader discussion on how formative feedback is approached in physics.

Formative tasks—whether assessed or simply for practice—are incredibly beneficial for student learning, but they take significant time to develop and implement. They require careful question design, realistic input values, calculated expected results, anticipation of student approaches (including common mistakes), and tailored feedback for each outcome. Creating these tasks with repeatable variations for authentic and novel practice becomes even more challenging, even when AI tools assist with question generation.

By tackling question generation by topic and exploring various elements of relevant equations—either individually or in combination—it becomes more feasible to envision a broader class of questions that can be procedurally generated along with feedback. Using a CAS in the question itself, or at least in the question generation process, allows for dynamic manipulation of equations, randomisation of input values, and even variation in which variables are given or need to be solved for. This approach also opens up opportunities for automatically generating response pathways, including common errors and corresponding feedback.

This workshop will highlight key considerations and strategies for generating formative quiz questions in a general context, before focusing on the specific benefits of using a CAS—whether integrated into a learning management system or used externally. Templates and examples will be provided, both in a general context and specifically as STACK question types in Moodle, which leverage Maxima as the backend CAS.

This will be followed by a broader discussion of how people are implementing formative assessments in physics courses.

Proceedings of the Australian Conference on Science and Mathematics Education, The University of Melbourne, 30 September - 2 October 2025, page 103, ISSN Number 2653-0481.