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Creating Engaging Learning Tools with Digital Assessments

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Abstract

- The project developed **open-source digital learning and assessment resources** on PrairieLearn, addressing challenges from university policies prohibiting fee-based tools.

- It provides instructors **flexibility, enhances students' experiences, and enables equitable, inclusive assessments**.

- The platform is fully compliant, **offering randomized questions, instant feedback, and reducing academic dishonesty**.

High costs for textbooks and integrated course software create barriers to education. Open-source digital learning environments can reduce financial burdens and increase flexibility for diverse learners. This project specifically developed an open-source question bank for digital assessments in engineering mechanics (Dynamics) and Physics, containing algorithmically generated questions promoting active learning. PrairieLearn's personalized problems, automatic grading, and instant feedback foster understanding and reduce academic dishonesty. Instructors can re-use and expand the question bank without access-time limitations.

Goals of the project

- Facilitating **active learning** and engagement in various class formats
- Providing **instant feedback** in assessments for improved performance monitoring
- **Reducing costs** and **enhancing accessibility** through an open-source platform

Project Outcomes and Deliverables

- A bank of algorithmically generated questions for the open-source platform, PrairieLearn
- Resources for engaging flipped classrooms and hybrid courses.

- Questions are categorized and tagged by topics and learning outcomes covering the syllabi of APSC181, PHYS111, PHYS112, PHYS121 & PHYS122. Questions can also be used in any other calculus- or algebra-based introductory physics course.
- A "sample course" with these problems for instructors wanting to replicate or adapt this course for their contexts.

Engaging lectures, promote active learning, monitoring students' performance and learning gains.
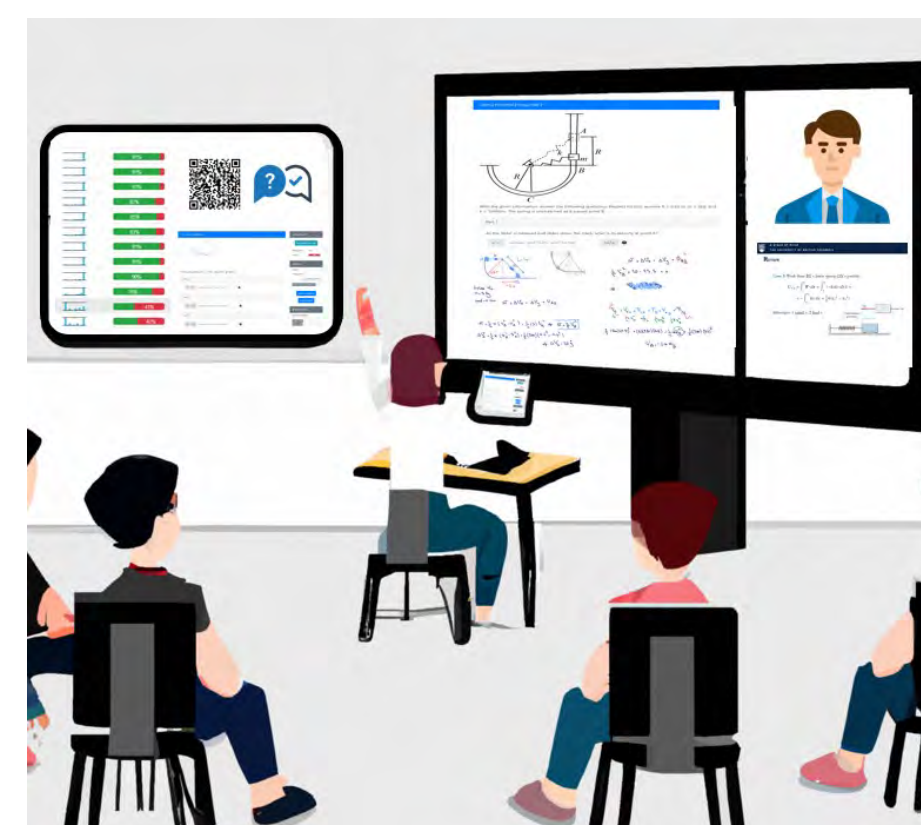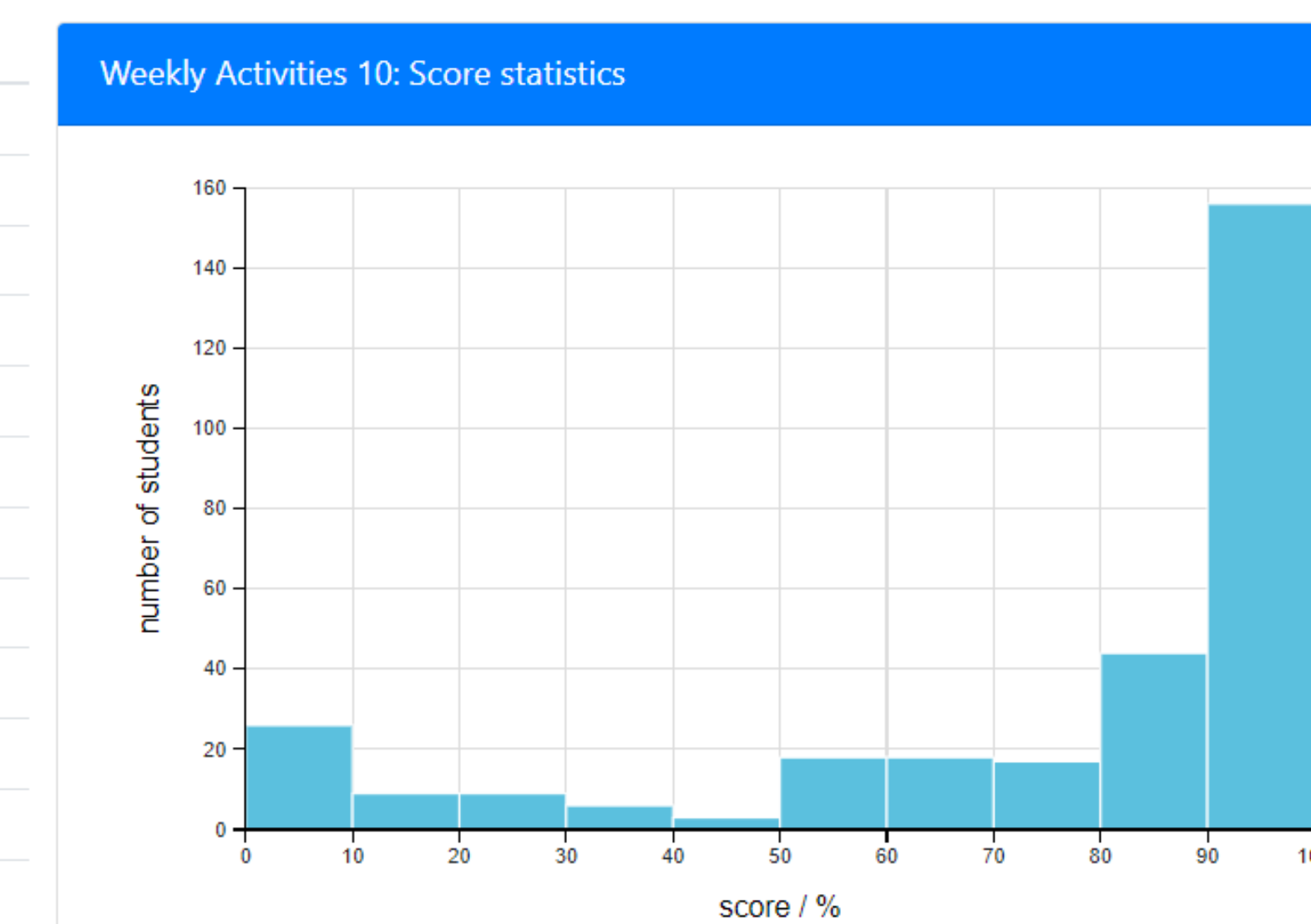

PrairieLearn

PrairieLearn is an open-source platform for creating interactive assessments. Instructors can generate different question types, like graphing and programming, with randomized parameters and feedback. Questions are written in Markdown and algorithmically randomized using Python. PrairieLearn features auto-grading, graphical drawing, and symbolic algebra, and provides statistics to modify lectures and assess learning gains.

Screenshot of a sample problem in APSC181

The Platform provides the instructor with information about students' performance and practice time

Sustainability Plan

- The developed resources target fundamental engineering and science courses, **ensuring their relevance in the long term.**
- Instructors and TAs can easily **update the content to accommodate syllabus changes**, keeping it current.
- **Detailed instructions are provided** to instructors & TAs for adding new questions to the resource.
- Solutions & hints are accessible to students after a set due date.

The project offers:
- A tailored Canadian version **accessible with UBC CWL** (ca.prairielearn.com)
- Advanced features for creating dynamic, auto-graded questions and handling various tasks, making it ideal for engineering education.
- A large, dedicated community with partners in the United States, Canada, and China, ensuring its availability for the foreseeable future.
- Compatibility with plain text (Markdown) for easy conversion to other platforms if necessary.

Project Evaluation

Monitoring course performance improves efficiency and inclusivity. Post-course survey measures student satisfaction. Documentation and sample course created for Open Problem Bank.

Participants: 120 (2021-22) & 114 (2022-23)

■ Positive Experience ■ Negative Experience ■ No Idea
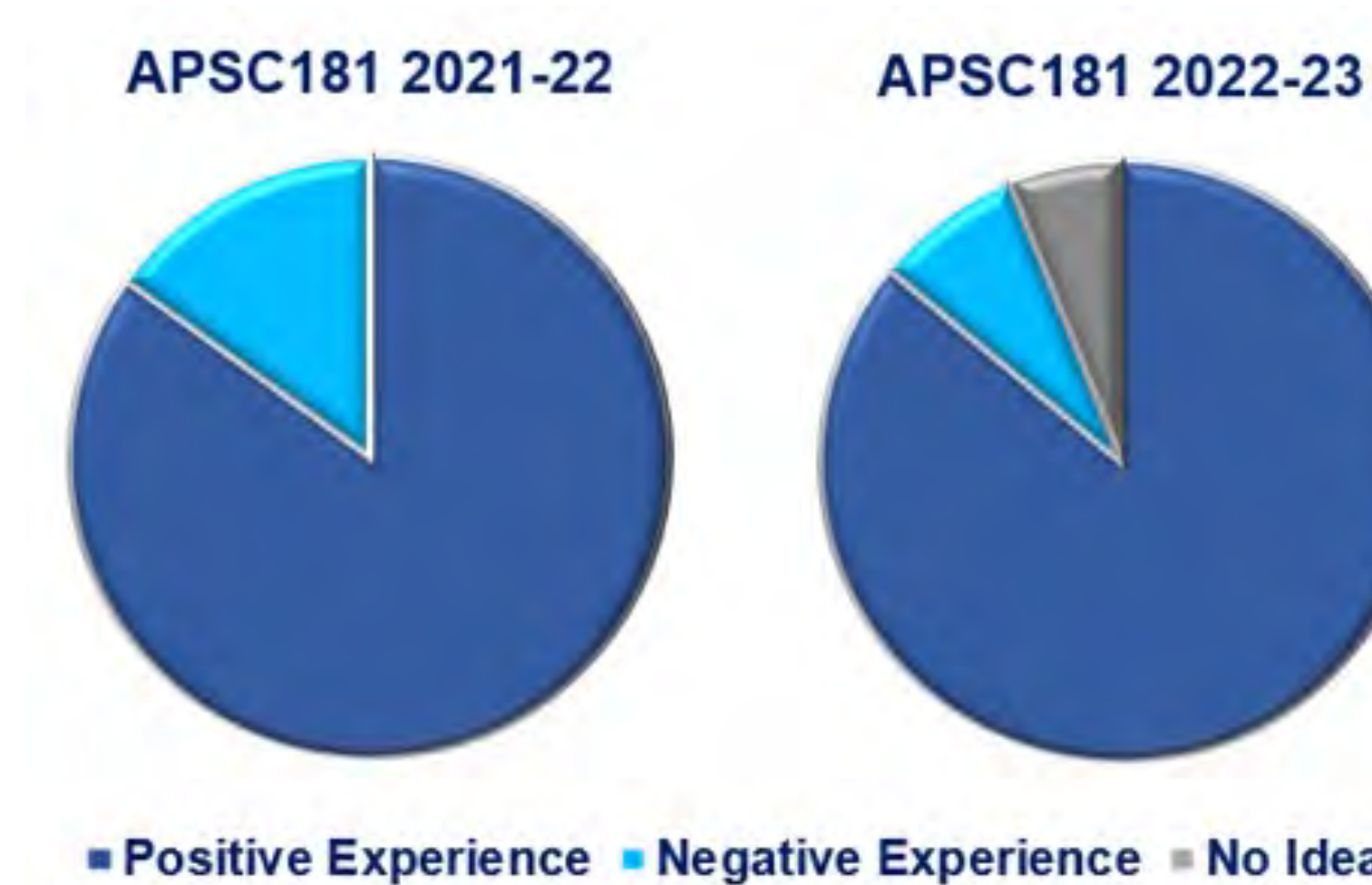
Question: *I feel that "Lecture Activity" assignments in this course helped me learn Dynamics...*

	2021-22	2022-23
Strongly Agree	49.6%	48.3%
Somewhat Agree	41.3%	38.7%
Neither Agree nor Disagree	5.8%	10.3%
Somewhat Disagree	1.7%	2.5%
Strongly Disagree	1.7%	0%

Acknowledgement