



D4.6 Good practice guidelines

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Executive Summary

ICT-INOV develops a gamified design thinking learning intervention for building innovation skills among Computer Science and Engineering higher education students. The project introduces a vertical implementation that addresses all aspects of fostering innovation in higher education, through the establishment of physical innovation labs, the design and implementation of a digital learning platform that promotes gamified design thinking, the design of educational activities that students deploy on-line collaborating in groups, instructor training, and community building for building organizational capacity to promote innovation for the benefits of wider communities.

This document a set of good practices that educators can apply for maximizing the positive benefits of the ICT-INOV learning intervention for innovation. The good practices are the result of educator experiences in the context of piloting activities taking place within the ICT-INOV project, in which students and instructors deploy the developed physical and digital infrastructures and content in actual courses. The good practices are organized in 3 tangents, namely preparation, content design, and implementation, supporting educators throughout the adaptation and deployment of the proposed innovation building learning design in their courses.

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Preparation



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Scaffold instructor competencies on applying design thinking

Why is this a good practice?

This practice fosters correct implementation of design thinking activities through good understanding of design thinking practices among instructors that deploy innovation skill building exercises in their courses.

Challenge

Despite having participated in instructor training, some instructors need further support for integrating gamified design thinking into their courses. If they are not fully prepared for deploying the ICT-INOV gamified design thinking learning intervention, they may not fully benefit from the added value of fundamental concepts of design thinking for innovation.

Solution

Organize small support sessions on a regular basis to allow instructors to discuss, inquire about, and share teaching plans. Piloting experience at UNITEN, Malaysia has shown that instructors at the early steps of their familiarization with design thinking can benefit from presenting their teaching plan for the upcoming semester to peers and receiving feedback and reinforcement. For maximizing the benefits of this practice, the teaching plan that instructors present should provide details on how and where they are going to apply design thinking methods in their teaching, assignments, and assessment. This is an effective method for verifying the accurate translation of their theoretical understanding of design thinking to practical implementation.

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Content design



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Select a problem that is linked to real-life experiences

Why is this a good practice?

This practice ensures student engagement in the learning process through activities that they can relate to and identify with.

Challenge

Students are more motivated to work on a problem when it is related to their interests and their experiences in real-life. Students are exposed to challenges faced by industry and society through the news, conversations with colleagues, scientific articles, and everyday experiences. These topics motivate students to apply the foundational knowledge they develop in their studies as well as their soft skills, including innovation capacity, for converting ideas into action or addressing pressing societal challenges.

Solution

When selecting an activity topic for design thinking, be in tune with emerging business trends or societal needs. To select a topic of interest, discuss with stakeholders in your region, including municipalities, companies, societies, or the public to identify areas of potential improvement of quality of life related to your discipline. Then structure an activity on a real-world problem. This approach will ensure not only that students will be exposed to actual challenges but also that their solutions will directly benefit their communities. Students will be more eager to address a challenge that they, their families, or their peers have experienced in real-life and will be in a better position to empathize with target users and to evaluate their solutions. This method will further demonstrate the link between innovation, growth, and community well-being.

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Incorporate sustainable development goals in your teaching

Why is this a good practice?

Sustainable development goals (SDGs) are a collection of 17 interlinked global objectives designed to be a "shared blueprint for peace and prosperity for people and the planet, now and into the future". The SDGs were set up in 2015 by the United Nations General Assembly with the objective of being reached by 2030. They are universal and tangible topics that cover most of the spectrum of human issues.

Challenge

The world is being torn by inequality and climate change, while at the same time it undergoes globalization. To share the burden of global issues the global community must act sustainably in all aspects of life, teaching and learning included.

Solution

To raise awareness and sensitivity of students on sustainability issues, it is sensible for educators to introduce SDGs in educational practices. The 17 SDG goals are further divided into 169 more specific targets that cover problems related to individual and community everyday life and wellbeing. As an educator, you can select a particular SDG related to the objectives and content of the course you teach and make it the focus of learning. This approach will enrich student educational experiences and will introduce an environmental, green viewpoint to educational outcomes.

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Introduce activities on redesigning processes for reducing emissions

Why is this a good practice?

This practice encourages students to think of innovative solutions for addressing SDG goals.

Challenge

Educational activities in all engineering curricula must raise awareness and build student skills for addressing the urgent need for reducing greenhouse gas emissions and managing air pollution. Students need to further understand the issues related to the scarcity of fossil fuel, and economic challenges related to importing petroleum products.

Solution

Design a learning challenge that encourages students to think innovatively towards reducing gas emissions. An example of potential activity may be related to converting an internal combustion engine to electrical. Ask students to prepare customized design for different models of vehicles by using design thinking approaches through the ICT-INOV gamified design thinking learning platform. To help students develop a good understanding of the problem, encourage them to explore existing old internal combustion engine vehicles in various organizations and offices and study electric vehicle technologies. Ask students to analyze and simulate their designs by developing and testing a prototype of a converted vehicle.

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Deployment



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Build student teams in an effective way

Why is this a good practice?

This practice helps educators, instructors, or teachers overcome difficulties in managing student activities, particularly in their early experiences of applying design thinking.

Challenge

Not all students would opt to work in a group, preferring individual work through which they can achieve results faster and manage their work independently. On the other hand, some students may face difficulties in researching a problem and may need constant guidance.

The role of the teacher, mentor, or facilitator becomes important particularly during the brainstorming activity for guiding students through the stages of generating ideas, evaluating ideas, and selecting for prototyping the idea that offers, based on criteria, the highest potential to address the problem in focus.

Solution

Provide students with additional activities focused on team building. The time spent in team building is an investment towards the reinforcement of working relationships and models among team members that will enable them to collaborate better and reach good results in all the phases of design thinking.

In addition, it is good practice to create small groups of not more than 4 individuals for more effectively managing the available time and task distribution among team members.

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Focus on specific design thinking steps in specific ICT courses for different types of learning strategies

Why is this a good practice?

Students need to go through the entire design thinking process to achieve learning objectives. Each design thinking step is important for the development of innovative solutions. Hence, no design thinking steps can be excluded in the learning process.

Challenge

Design thinking can be time consuming to implement within a specific learning strategy. ICT courses can be very technical and fundamental. To achieve the best learning outcomes design thinking must be applied to subjects that are problem-based and require innovative solutions development. Design thinking includes multiple steps and requires longer learning sessions for maximizing benefits. Instructors must have a full understanding of the design thinking process to apply it in different types of learning strategies.

Solution

Design thinking can be applied in diverse ways. Educators can identify real-world problems related to their course and carefully integrate design thinking steps in classroom activities. A 1-hour tutorial introductory session can be used to present design thinking steps, which can later be implemented as part of the teaching and learning process. A full design thinking cycle can be completed with good results over a 7-week project-based learning plan.

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Deployment

Encourage students to share their intermediate design and learn from each other

Why is this a good practice?

Design thinking is an inherently learner-centered approach to innovation. Students do not only learn from educator guidance; they can greatly benefit from peer learning beyond their team by sharing their designs, providing, and receiving feedback with the entire class.

Challenge

Encourage students to be open to feedback and to share ideas with their group and others. This will allow students to consider diverse viewpoints and it will broaden the pool of ideas towards designing a feasible solution that addresses real user needs.

Solution

Encourage students to present their findings after each design thinking step to the entire class. Make sure that presentations are conducted in an inclusive environment with positive mindsets so that feedback is constructive. Ensure that students understand that there are no bad ideas, but that they can benefit from building on each other's contributions.

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Create an activity that challenges students through time pressure

Why is this a good practice?

Time pressure is a gamification element that increases the intrinsic difficulty of a learning activity. The introduction of time pressure in learning utilizes design thinking in an innovative, different, and playful way while creating challenges that motivate students.

Challenge

Some games include mechanics related to time management; players must solve challenges in a scheduled manner. This mechanic is used, for instance, in escape rooms. For most individuals this is a highly effective mechanic that fosters the motivation of the player. The ICT-INOV platform can be used in a synchronous way so that the teacher releases time-stamped challenges that must be released by participating groups within a specific timeframe.

Solution

An educator has a lot of options for designing an interesting scenario by creating a set of challenges related to a societal problem close to the students' interests. The challenges should be related to the selected problem, encouraging students to research information, solve puzzles, and more. The higher the variation in selected challenges, the better.

Educators may further deploy a ranking of teams based on the time each group takes to solve a set of challenges. This mechanic introduces rewards in the form of recognition, motivating student engagement in learning.

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Engage students in curriculum syllabus design

Why is this a good practice?

This practice provides educators and students with a common, jointly agreed reference point that sets the stage for learning throughout the course. It ensures that the course addresses student interests. Upon completion of the course, students develop the knowledge and skills that they consider to be important.

Challenge

To effectively design a course educators must consider issues related to integrating motivational for students learning activities, identifying prerequisite knowledge and skills, and defining learning objectives to be achieved by course completion.

Solution

As an educator, provide students with specific and clear instructions and suggestions for executing learning activities. Allow students to explore the course content and to set goals related to their interests and needs. Then, encourage students to share their thoughts and ideas in groups to develop a set of achievable learning objectives. Encourage students to design in groups prototype solutions to real-world problems. This approach will contribute to the development of both group collaboration independent work capabilities.

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Reward students upon completion of each assigned task

Why is this a good practice?

This practice helps teachers motivate students and encourages them to join different class activities.

Challenge

Increasing student motivation and encouraging them to be active in class is a typical educator's concern. Students may lose desire to work on specific assignments if they do not feel that their time and effort will be rewarded. For instance, students may ignore a reading assignment if that information is not required in tests or examinations. Moreover, students may not finish an assignment with the desirable quality if the required implementation time and effort are disproportionately high considering rewards in the form of points or grades.

Solution

The educator can provide rewards or points for students after they achieve academic objectives. The rewards after each achievement can be something small but different at each time to stimulate student curiosity and eagerness to work and to see what they can get at the end. Another way is to give points for each achievement and at the end of the course reward the highest cumulative achievement in all assignment. Giving points is not only a good way to motivate students but also can help track progress.

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Provide immediate feedback upon completion of each assigned task

Why is this a good practice?

Feedback helps students track their progress and self-access what they have learned.

Challenge

Students sometimes make errors, but they don't know why their response is wrong. In other cases, students may give the correct answer, but still be uncertain about the quality of their solution.

Solution

Provide feedback upon completion of each assigned task. Feedback will help students understand why their response is correct or incorrect. Through the feedback, students can identify and track their own improvement. Feedback allows students to establish connections between cause and effect of their choices and actions. It further allows them to determine the effort they need to invest to succeed. Moreover, immediate feedback for one student also helps the others learn from their friends' errors or accomplishment.

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