**CMPT 415 : Directed Studies Project Proposal**

**Summer 2022**

Submitted by :

Advisor : Dr. Hazra Imran

**Project Proposal**

**Title :** **Developing a Personalized Gamification System to Teach Python**

**SUMMARY :**

Programming courses in computing science are important because they are often the first introduction to computer programming for many students. Many university students find themselves to be overwhelmed with the information they are presented with in an introductory course. The current teacher-lecturer model of learning that is commonly employed in university lecture halls often results in a lack of motivation and lower participation in learning. Applying elements of gamification to programming courses has been shown to be able to impact motivation, participation, and overall learning outcomes in a positive way.

Existing applications of gamification in programming courses neglect personalization; every student is shown material in the same presentation and evaluation, despite preferring certain forms of presentation and evaluation over others. This research project intends to investigate personalization and gamification in the context of introductory programming courses by developing a course learning-management system that employs gamification factors and personalization features. Further, this project will collect data on a sample of the performance of students in an introductory programming course and try to answer the following question: does a personalized gamification system improve student’s cognitive and social well-being in an introductory Python course?

**Problem Statement:**

RQ: *How does personalized gamification in learning environments affect cognitive and social well-being of a student?*

Hypothesis: *If students in an introductory programming course use a personalized gamification system, then their cognitive and social well-being will be improved.*

**Proposed Research Direction(s):**

The objective of this research project is to create a personalized gamification system for an introductory Python course and to determine whether this system is effective in improving student’s cognitive and social well-being.

The personalized gamification system that will be developed will contain a couple of introductory Python topics. The presentation of the material will be available in videos, step-by-step tutorials, and lecture slides. The evaluation of the material will be available in multiple-choice and true/false tests or coding exercises. All evaluation of the material will be automatically evaluated. The student will be rewarded with achievements, scores, and badges. They will also be able to see their relative position on a leaderboard. After each subsection of material, one group of students will be asked to evaluate the form of presentation and form of evaluation and the learning system will adapt to those responses. The implementation of the gamification system will be presented on a poster.

A research proposal paper will be created as the personalized gamification system will eventually be deployed to CMPT 120 students. Prior to students participating in the research study, the research project will be explained to them and a consent form will either be accepted or declined. Students will also be informed that they may withdraw from the study at any point in time, and will be provided contact information for the purpose of research questions or withdrawal of data. There will be four groups of students:

1. Students who are **not shown** any gamification features and personalization **does not** take place
2. Students who are **shown** gamification features and personalization **does not** take place
3. Students who are **shown** gamification features and personalization **does** takes place
4. Students who are **not shown** gamification features and personalization **does** takes place

After research is completed, students will be debriefed. Data collected will be tested through statistical analysis and a conclusion will be made. The personalized gamification system and data will be evaluated and analyzed in a research paper. Finally, a project report will be created.

**EVALUATION CRITERIA:**

**Project Deliverables:**

The following are the expected deliverables for this Directed Studies:

1. The student performs a literature review of the existing state-of-the-art in personalized gamification of introductory programming courses and is able to document it, with references
2. Writing a 2-3 page document on the above literature review with proper references.
3. The student creates plans, designs, and diagrams of a gamified learning system with personalization for a full Python introductory course
4. The student develops a gamified learning-management system with Python exercises and an interactive live code editor
5. The student adds personalization of the presentation of material based on students’ feedback after each “lesson” to the learning-management system
6. The student adds surveys that each participant completes prior to and after using the system; these surveys ask questions about prior experience, general opinion on personalization and gamification, as well as student’s self evaluation and self-described cognitive and social changes
7. The student analyses which limitations of traditional introductory-programming education and current gamification platforms are addressed by the above design
8. The student submits a project report of work done in points 1-7, as well as a paper for the research conducted in point 6
9. The student publishes a survey paper/poster or presents their findings at a seminar, conference or a similar platform

[Non-Gradable]

1. The student works with the faculty to further develop the learning-management system and to improve personalization.

**Project Timeline:**

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| Date | Milestone |
| May 10, 2022 | Literature review + Writeup |
| May 17, 2022 | Planning + design |
| Jun 6, 2022 | Implementation of course learning-management system |
| Jun 20, 2022 | Exercises designed and interactive code editor created |
| Jul 4, 2022 | Implementation of gamification and personalization |
| Jul 9, 2022 | Create surveys for before and after, built-in to the system |
| Jul 18, 2022 | Implementation (poster) |
| Aug 1, 2022 | Proposed research approach (paper) |
| Aug 8, 2022 | Project report |

**Grading Scheme:**

**A+ : Student meets 95% or more of the project deliverables ( 9 of 9 )**

**A : Student meets 90% - 95% of all project deliverables**

**A- : Student meets 85% - 90% of all project deliverables**

**B+ : Student meets 80% - 85% of all project deliverables ( 6 of 7 )**

**B : Student meets 75% - 80% of all project deliverables**

**B- : Student meets 70% - 75% of all project deliverables**

**C+ : Student meets 80% - 85% of all project deliverables ( 3 of 7 )**

**C : Student meets 75% - 80% of all project deliverables**

**C- : Student meets 70% - 75% of all project deliverables**

**D : Student partially meets at least one project deliverable ( 1 of 7 )**

**F : The student does not meet any project deliverables ( 0 of 7 )**

**N : Student does not complete the course ( 0 of 7 )**

**REFERENCES:**

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S. Király and T. Balla, “The effectiveness of a fully gamified programming course after combining with serious games,” *Acta Didactica Napocensia*, vol. 13, no. 1, pp. 65–76, 2020.

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**IDEAS FOR FOLLOW-ON WORK:**

My main idea for follow-on work is to provide personalization in the format of material presentation. The currently existing research in gamification of introductory programming courses shows a positive increase in grades, but there is not a lot of research that combines personalization and gamification and analyzes the results.