

CULTIVATING ACADEMIC SELF-EFFICACY THROUGH SUPPORTIVE SOCIAL AND SELF-REGULATED LEARNING STRATEGIES FOR STUDENTS IN HIGHER EDUCATION

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ABSTRACT

This research set out to enhance engagement in computer programming, a known difficult subject area for 1st year BSc in IT students. Programming lecturing staff had strong reservations about introducing group work in their classes, claiming group work was a counter-productive learning approach. The study was framed on a mixed-methods action research approach, and a number of interventions, centred on reflective learning and social learning, were introduced. The findings indicate a strong preference by students to work in groups when tackling computer programming problems, but no strong evidence was found that reflective or social learning activities enhance programming skill level. A key contribution to practice was the introduction of a student mentoring academy within the institution, with programming as a central theme.

RESEARCH QUESTIONS

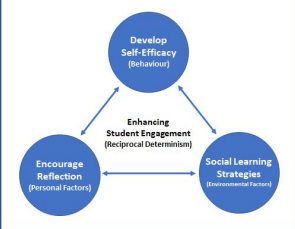
The four questions below represent the core focus of the entire study:

- Q.1.** Is a **Reflective Learning Journal** a useful and effective tool for engaging students in computer programming?
- Q.2.** Can the use of social learning strategies enhance engagement?
- Q.3.** Are social learning strategies, such as **Problem Based Learning** and **Peer Assisted Learning**, effective tools for engaging students in computer programming?

CONCEPTUAL FRAMEWORK

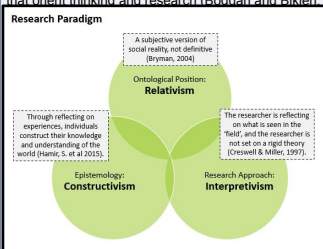
The conceptual framework below, was developed from Bandura's (1986) Reciprocal Determinism model, in which Behaviour, Environmental Factors and Personal Factors were replaced with Self-Efficacy, Social Learning and Reflection, which became the basis for developing implementation strategies to enhance student engagement.

Conceptual Framework: Enhancing Student Engagement
(Adapted from Bandura's Reciprocal Determinism Model (1986))



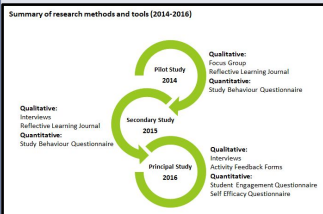
RESEARCH PARADIGM

The empirical research studies were based on an interpretative approach, which allowed for greater freedom to include personal views and interpretations, and to form knowledge inductively from views and experiences of participants. The diagram below characterises the research paradigm for this study, which can be described as a loose collection of logically related assumptions, concepts, or propositions that orient thinking and research (Bogdan and Biklen, 1998).



Research Methods

The diagram below highlights the methods and tools used over the course of the action research study.



Data Collection

The table below is a summary of the data collected for the study.

	Analysis	Sample
Pilot Study - 2014		
Student study habits questionnaire	Quantitative	31
Reflective Learning Journal	Qualitative	77
Focus group (reflective journal evaluation)	Qualitative	7
Secondary Study - 2015		
Student study habits questionnaire	Quantitative	53
Reflective Learning Journal	Qualitative	18
Interview (evaluation and study habits)	Qualitative	4
Principal Study - 2016		
Student Engagement & Self-Efficacy Questionnaire - (Treatment Group)	Quantitative	44
Student Engagement & Self-Efficacy Questionnaire - (Control Group)	Quantitative	31
Interview (start and end of semester with formal programming lecturer)	Qualitative	1
Interview (end of semester with treatment group participants)	Qualitative	4
PBL/PAL activity feedback forms (six sessions)	Qualitative	46

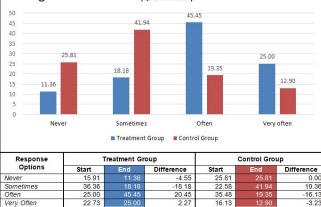
FINDINGS

Reflective Learning

A reflective learning journal was provided to student participants in two of the action research studies, participants were asked to complete this journal on a weekly basis over the course of a semester. There was mixed opinions on the use of the journal, with the majority questioning its usefulness. Students were not convinced of the benefits of using the journal over a long period of time, and found the activity a burden in some cases. Some viewed it as a piece of additional assessment that had no grade, furthering most to question the benefits. While some positive benefits were noticed, careful consideration is required if using such a tool for a class cohort, some individuals seemed to adapt better to this type of journaling activity than others.

Student Engagement

A student engagement measurement tool was provided to student participants at the start and end of a semester. A social learning intervention was applied to a treatment group, and the engagement scores across both the control and treatment groups were measured. The results revealed a small increase in total student engagement group score for the treatment group, but nothing significant. However, interesting findings were found in some of the individual questions, the figure below represents one example of this, in which the treatment group had scored considerably higher than the control group in a question relating to understanding people dissimilar to themselves, which would have been influenced through the social learning activities that the treatment group participated in. This, in itself, was an encouraging finding.



Social Learning (PBL and PAL activities)

Problem Based Learning (PBL) and Peer Assisted Learning (PAL) were introduced to a treatment group over the course of a semester. The quotes below represent a small sample of the overall positive feedback the participants expressed in terms of their enjoyment in participating in groups when solving programming problems:

"I learned I can work in a group. Although I most of the times would rather work alone, working in a group does make problem solving a lot easier."

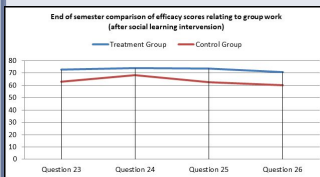
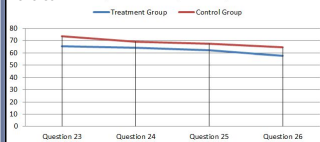
"I enjoy programming but I'm 100% aware that my planning skills are way better than my programming skills. I wish we had more opportunities like this one to practice."

"Really enjoyable as I am better working with people. (I'm a really nervous person and individual evaluations makes me so nervous that I cannot concentrate."

"These activities really makes more interaction among friends and for a given problem, we can solve it with many the best ways. And need to be continued in the coming years."

Self Efficacy

Participants were provided a self-efficacy questionnaire, based on a approach suggested by Bandura (2006), to complete at the start and end of a semester. A social learning intervention was introduced to a treatment group, and the overall self-efficacy group score comparison revealed very little, other than a slight increase in the treatment group score. However, a significant finding was found when comparing the final four questions measuring the perceived ability to work within a group. To illustrate this, the first figure below represents the start of semester self-efficacy group score for both groups, followed by the second figure representing the end of semester self-efficacy score reversal.



CONCLUSIONS

A summarised answer to the research questions are presented below:

- Q.1.** Both of the studies on the use of a reflective learning journal were mostly negative, in that students did not find it beneficial, and in cases, saw it as an additional ungraded piece of assessment.
- Q.2.** There was evidence to suggest it does, specifically relating to group based activities, and communicating with peers. However, it is difficult to say positive findings were directly linked to the social learning activities introduced over the semester.
- Q.3.** The use of PBL and PAL was very successful in engaging students in computer programming, the students engaged in the activities and requested more of these activities in the future.
- Q.4.** There was no strong evidence to suggest social learning improved self-efficacy in computer programming, however, there was strong evidence for the use of social learning in group work enhances self-efficacy in working with others in group settings.

self-efficacy

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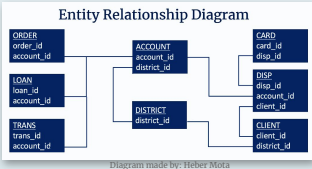
Abstract

The core objective of the **CH Banking Solutions** project is to make use of machine learning techniques to detect and prevent fraudulent transactions within a provided dataset effectively. Our approach involves constructing a robust system adept at managing financial data while also integrating additional features such as a currency converter to enhance financial management capabilities.

Furthermore, we aim to utilize the properties of the dataset to generate insightful visualizations depicting customer behavior patterns. These visualizations will empower our clients to identify trends and valuable insights crucial for their business operations. Through these features, we will develop a comprehensive Banking Solutions initial product that in the future could stand out in the market, offering competitiveness.

Data Understanding

The database, curated by Petr Berka and Marta Sochorova comprises financial data sourced from a Czech bank, encompassing details of over 5,300 bank clients and approximately 1,000,000 transactions [1]. This research aims to explore resources, limitations, assumptions, and various other factors. In establishing goals for data mining and machine learning, we can make use of their capabilities to visualize valuable insights, improve decision-making processes, and implementing effective solutions that hold tangible benefits and enhance organizational value. Below, we can see a diagram of our datasets before being merged into one:



Data Understanding

After extensive Data Cleaning and Preparation, Exploratory Data Analysis (EDA) was carried out, enabling us to acquire valuable insights into the nuances of our dataset unveiling underlying characteristics, as exemplified next:

Figure 1: The visualization depicts a significant clustering of individuals aged between 18 and 65, suggesting heightened engagement within this age bracket. Moreover, within this range, there is a discernible peak, notably observed among individuals in their 30s to 50s.

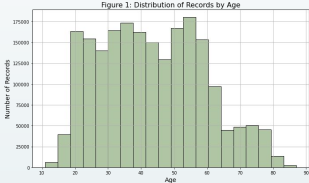


Figure 2: The majority of records in the Average Salary indicates a cluster within the range of 325-370 euros on average with over 350,000 people, suggesting a prevalent income bracket among the sampled population. Interestingly, there is a secondary peak observed around 500 euros, indicating another significant concentration of wealth.

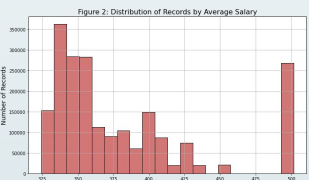
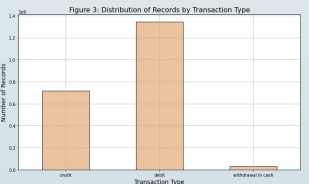


Figure 3: A clear trend in transactional preferences can be noted, with debit cards emerging as the most commonly utilized payment method, followed by credit transactions and cash withdrawals. This observation underscores the significance of digital payments security in modern financial transactions.



Modelling

- 1. Data Cleaning and Merging:** Unnecessary columns will be dropped, and remaining features will be renamed for clarity and consistency. Cleaned datasets will be merged based on common columns.
- 2. Data Visualization:** Features of interest will be visualized to explore their relationships within the dataset using EDA.
- 3. Data Preparation:** Numeric features will be normalized using MinMaxScaler to ensure they are on a similar scale. Categorical columns will be transformed into binary sub-columns using One-Hot Encoding. Standardization techniques will be applied to further preprocess the data. Principal Component Analysis (PCA) will be utilized for dimensionality reduction.
- 4. Applying Models:** Models such as Random Forest Regressor will be employed for detecting fraudulent transactions.
- 5. Model Deployment:** Once deployed, the model will be ready to receive input data, make predictions, and provide valuable insights to end-users or other downstream systems. [3]

Findings

Add your information, graphs, and images to this section.

Conclusion

Add your information, graphs, and images to this section.

References

[1]. 1999 Czech Financial Dataset - Real Anonymized Transactions - dataset by Ipetrocelli (2019) data.world. Available at: <https://data.world/1petrocelli/czech-financial-dataset-real-anonymized-transactions> (Accessed: 12 March 2024).

[2]. <https://webpages.charlotte.edu/mirsad/itcs6265/group1/index.html> (Accessed: 12 March 2024).

[3]. <https://github.com/carolinedesat/capstone-pair-project> (Accessed: 20 March 2024).