MyMentor: A Web-Based Math Online Tutoring System using Item-based Collaborative Filtering for Tutor Recommendation of SHS Students in Catalunan Pequeño National High School

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Item-based Collaborative Filtering, K-Nearest Neighbor Algorithm, Pearson Correlation Algorithm, Tutor Recommendation, Peer-tutoring Application

# INTRODUCTION

## Project Context

Tutoring refers to an instructional method in which a tutor teaches or guides a tutee about a specific subject matter or for a particular purpose by providing explanations, modeling targeted behaviors, or providing prompts and feedback to students' performance [1]. School administrators, teachers, and parents have become increasingly concerned about the problems students' are facing today that are manifested in some schools in various areas such as decreased academic achievement, increase absenteeism, lack of interpersonal skills, and inability to think critically [2]. Peer tutoring consists of students teaching other students of the same or different age, on a one-on-one basis or one tutor working with two or three students simultaneously [3]. Peer tutoring has been widely used across academic subjects. It has been shown to result in academic achievement within a wide range of subject areas for a variety of learners, just like an educational and cognitive benefit.

Catalunan Pequeño National High School has an estimate of 700 Senior High School students currently enrolled in the school year 2019-2020. The school offers academic tracks in Accountancy, Business and Management (ABM), and General Academic Strand (GAS). According to students from both educational records, mathematics is one of the subjects they are having difficulty in particular with algebra, trigonometry, and calculus.

Class advisers and subject teachers can determine who the top performers are and who require assistance, in particular with mathematics. The first problem is 67 out of 100 students from GAS and ABM strand are having a hard time with mathematics, common reason by the students is having a massive volume of class that the subject teacher cannot attend to all concerns of the students. The second problem is existing cooperative learning that students initiate inside the classroom, either within class hours or after. Top performer students begin to assist co-students, who is having a hard time with the lessons. The third problem is some students are timid to seek for assistance to top performer students — for instance, an attitude problem by the top performer that belittle co-students for asking support.

With such problems within the School vicinity, the proponents are encouraged to develop a web and mobile responsive peer-tutoring application that would help the school organization and its students to be more competitive in terms of education.

## Purpose and Description

The proponents of the study aim to develop a peer-tutoring web application with tutor recommendation implementing item-based collaborative filtering using the Pearson correlation coefficient and k-NN (k-Nearest Neighbor) Algorithm to help students find the best-fit tutors for students that need assistance with mathematics. The proposed system provides a live video conferencing between tutor and tutee about the course selected by the tutee. By this feature, it will have a much secure process of peer-tutoring as both tutor and tutee does not need to meet in person and outside school hours for security purposes that might occur. Also, for all students registered in the web application, they will receive an SMS-notification for updates of new course opening for video conferencing or in-school tutoring services.

The School Principal will administer the account creation of the students to avoid any fraudulent accounts. Second, for the traditional peer tutoring service, all sessions will take place inside the school campus. Another option is online, where the proposed platform connects students to tutor and tutee to an online conference room where both can exchange ideas about the lesson. Third, the proposed application will have no monetary involvement between the tutor and the tutee. However, upon agreement with the school administrators, a reward system will be given to the qualified tutors.

The Catalunan Pequeño National High School will be the administrator of the proposed web application. Using the web application, the administrator will keep track of the records such as; student list, qualified tutors, course creation, and tutoring session details. The beneficiary will benefit as it would help students build their confidence towards education and to have a strong foundation as they enter college.

## Objectives of the Study

### **General**

Generally, the proponents aim to develop a math peer-tutoring application for Senior High School students in Catalunan National Pequeño National High School with the implementation of the Item-based Collaborative Filtering using Pearson Correlation coefficient and K-Nearest Neighbor Algorithm for tutor recommendation.

### **Specific**

To achieve the general objectives of the proposed web application, the proponents aim:

#### To develop a web and mobile responsive app that allows students to interact with each other using Node.JS, React.JS, and implementing the Node Express framework.

#### To create an admin panel for the project beneficiary to create accounts, lesson courses, and account management to view information using JavaScript and MySQL.

#### To manage the course, tutor, and tutees using hosted MySQL database implementing JavaScript Object Notation (JSON) parsing.

#### To notify users for course content updates created by the Admin using Diafaan SMS Server.

#### To rate and calculate the tutor by implementing the Pearson Correlation to associate the ratings of other tutors with similar user preferences with the use of the K-Nearest Neighbor Algorithm utilizing Euclidean Distance Formula to find the closest similarity scores as the basis of the recommendation to a potential tutee.

#### To recommend a tutor according to user preference in terms of time, course, and competence using item-based collaborative filtering.

#### To collaborate with other students who accessed the peer-tutorial system using Node.JS, React.JS, Node express framework, and WebRTC for both tutor and tutee to connect in a live video session, and screen-sharing to demonstrate the sample lessons within the scope of the course student is taking.

**1.3.2.8** To rate and write reviews to determine the effectiveness of the proposed system and the needs of users for future improvement.

## Scope and Limitation

The system is composed of a web-based administration module and user module, which will be and can only be accessed by the CPNHS (Catalunan Pequeño National High School) School administrator and senior high school students. The application cannot be accessed without an internet connection.

The web application for users will include the following functionalities: user(tutor and tutee) user profile management, search feature for tutee, tutor rating module for tutee, tutor recommendation module for tutee, feedback module for both tutor and tutee, live video conferencing between users using WebRTC, tutor booking for in-school tutorial, and real-time chat between users.

Several conditions are to be considered, according to the School Principal. First, there will be no monetary involvement between tutors and tutees. However, Tutors under the subject teachers will give a reward system to all qualified tutors. Second, reward system information is discretional between school administrators and tutors. Third, lesson modules to be used as a reference to the course shall be provided by the subject teachers. Fourth, all students who select the traditional tutoring, sessions will only take place inside the school campus as the principal already allotted a venue to where the conventional coaching takes place, the site would be either the vacant laboratories or study hall.

The web application for the administrator includes the following functionalities: account management for students, course creation for the tutor, SMS-notification for students, and monitoring feedbacks for both tutor and tutee using Diafaan SMS Server.

The system developer or the website administrator will not be accountable if disconnection occurs between tutor and tutee while the course session takes place.