

THE TOURNAMENT: VIRTUAL GAME USING 3D VECTORS

Yoshihiro Yamada, Hitoshi Nishizawa, Takayoshi Yoshioka
Toyota National College of Technology, Japan
E-mail: nisizawa@toyota-ct.ac.jp, yoshioka@toyota-ct.ac.jp

ABSTRACT

A virtual game is designed to introduce linear algebra to pre-college mathematics in Japan. The rules and mechanism of the game is shown graphically using 3D vector operations, so the students have graphical image of vectors and feel the reality in them before they start learning vectors and their operations in traditional lessons.

The game is a tournament (see Figure 1), where an avatar of a student or a team of avatars compete with the opponents in different kind of battles in the virtual world at every stage of the tournament.

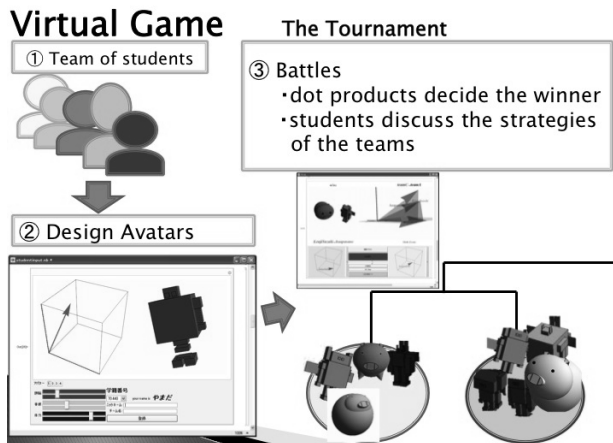


Figure 1. The tournament.

Every student owns an avatar for the game, and the avatar has a characteristic vector of three elements: physical strength, thinking ability, and musical skills. The tournament is fought between the teams of avatars. The teams compete each other in a battle and the winning team proceeds to the next stage. The battlefields also have 3D characteristic vectors, and the winning teams of battles are decided by vector operations (see Figure 2).

Dot product calculates the effective strength of each player in a battle, with his performance in the battlefield. Vector addition calculates the characteristic vector of each team in a team battle, and absolute value of a vector is the maximum strength of a player. These operations are first shown graphically in the game, and later explained using their symbolic operations in the rulebook, which becomes the introduction to formal lessons of vector operations.

The Battle

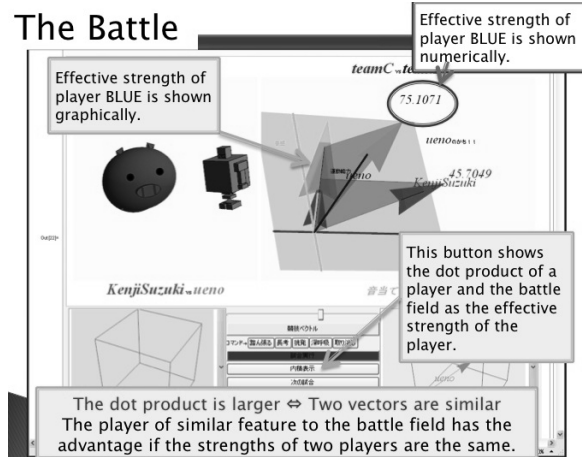


Figure 2. Displaying the winner of a battle graphically.

The game is conducted by a client/server system in the college LAN environment. The students' modules, which work as front-end modules, are programmed with a computer algebra system Mathematica using its graphic interface, a built-in function called *Manipulate*, its database-link function, and its programming language. *Manipulate* is the function which enables immediate changes of graphic objects in the screen of a student's module triggered by the users' operations. All the data are stored in a database server constructed with PostgreSQL and accessed from front-end modules through the database-link function.

Students use the system through front-end modules installed to the computers in the college laboratory. They design their avatars on the computers and register to one of the teams before the actual lesson of 3D vector operations. The activity doesn't require any prior knowledge of vectors. After the registration of the students, the system decides the matchups in the tournament, and holds all the information necessary to conduct the virtual game in its database.

CONCLUSIONS

A virtual game shows graphical image of 3D vectors and their operations in the virtual 3D space, and the students become familiar to the graphic image and be ready to learn before traditional lessons.

We believe that the learning has much reality after this game, and is more meaningful to engineering students.