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Development of board game as teaching aids for basic electronics courses

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ABSTRACT

A variety of teaching methods can help increase students' interest and focus on a subject. A game -based learning approach is suitable to be used by students for them to enhance their problem solving skills directly or indirectly during the game session. The students have difficulty remembering and understanding the symbols, structures and functions of electronic components causing them failed to answer assessment questions well. This teaching aids are specifically designed to enhance students' understanding of basic electronics courses that have a variety of name, symbols, structure and functions to remember. Also suitable use during learning sessions because it can increase students' understanding through rapid learning and revision while playing. Due to limited electronic-based board games in the market, The Components was suggested as one of the learning tools, especially in the field of electrical engineering.

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Introduction

In the early stages of the learning system introduced in Malaysia, students and teachers faced difficult situations in terms of competition, lack of infrastructure and learning tools, non-conducive environment and limited ability to understand context and concepts including weaknesses in communication systems between parents, students and teachers (Jamaluddin et al., 2016). Over time, students and teachers have been brought to a new dimension in the world of education namely creative and critical thinking skills in teaching and facilitation (PdPc) (Abd Rahman et al., 2021). A board game is a game term that involves moving or throwing a pieces on the board according to the format prescribed by the developer of the board game (Noda et al., 2019). There are various types of board games on the market such as chess, monopoly, scrabble and so on. This game -based learning method is suitable for use in the problem -solving process by combining either directly or indirectly in teaching and learning (Mohd Mydin et al., 2021). The improvement of teaching and learning concepts, especially from teaching aids and gamification approach can create an active and interactive classroom atmosphere which in turn can attract students' interest and attention to focus and increase understanding of a learning topic (Ab Rahman et al., 2021). Exposure to board games for language learning can indirectly improve the vocabulary mastery of students whether school or college students. Thus able to improve English proficiency among students and college students (Zulkiflee Chandra, 2013). Furthermore, the use of game boards makes students more motivated to participate actively during learning sessions (Desa et al., 2021; Kim & Park, 2019; Triastuti et al., 2017; Rahayu, 2016; Setyaningsih & Dewi, 2015; Hawkinson, 2013). The Components was developed based on Gagne's Theory of Nine Learning Events. Based on Gagne's theory, 9 events to be observed

are to get attention, explain learning objectives, stimulate memory of things learned, present learning materials, provide learning guidelines, train new skills, give feedback, evaluate achievement according to set objectives and application to the actual work environment (Ab. Wahab, 2016). Gagne theory has helped in organizing ideas and formulating objectives appropriate to the needs in the basic course of electronic components.

The main objective of this project is to develop board games as teaching aids for basic electronics courses. These teaching aids are specifically designed to enhance students' understanding of the basic components of electronics that have a variety of names, symbols, structures and functions to remember. Most students easily feel drowsy and bored during theoretical learning, causing them difficult to remember the names, symbols, structures and functions of various electronic components. Students are able to increase their understanding through questions that need to be answered while playing. The failure of students to master the theory of basic components cause them failed to get good results in exams. In addition, through this game entrepreneurial values can be applied among students through buying and selling components while playing.

Method

The Components is a board -based game designed as a teaching aid for basic electronics courses. It was developed using the SCAMPER technique to ensure the development process runs properly, directed meets the requirements of the course syllabus. Figure 1 shows the process of SCAMPER technique being used.

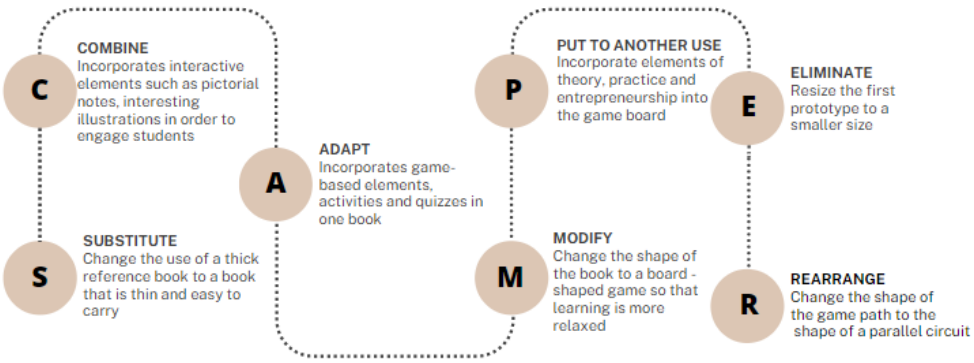

Figure 1. SCAMPER design process

The Components is adapted from popular board games such as Monopoly and modified to fit the basic course content of electronic courses. It is incorporating basic elements in electronics such as recognizing components, functions and positions of components in a circuit. The Components is suitable to be played by 3 - 5 players. Throughout the game, players are introduced to the concept of parallel circuits, mind testing questions of the basics of electronic components and the basics of entrepreneurship through component trading. The concept of basic parallel circuit is used to design the main circuit as shown in figure 2.

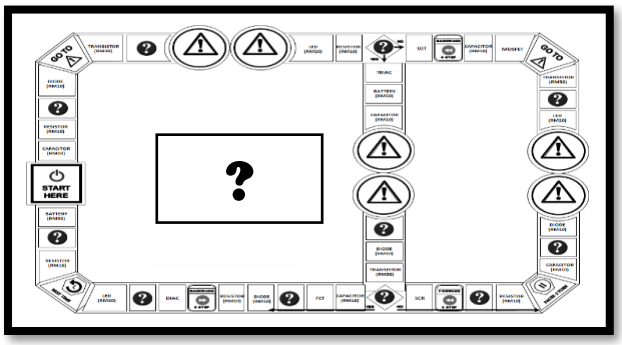

Figure 2. The Components game layout

Based on main board, during game session player will play either route 1 or route 2 depends on their answer at the junction. Figure 3 shows the route options.

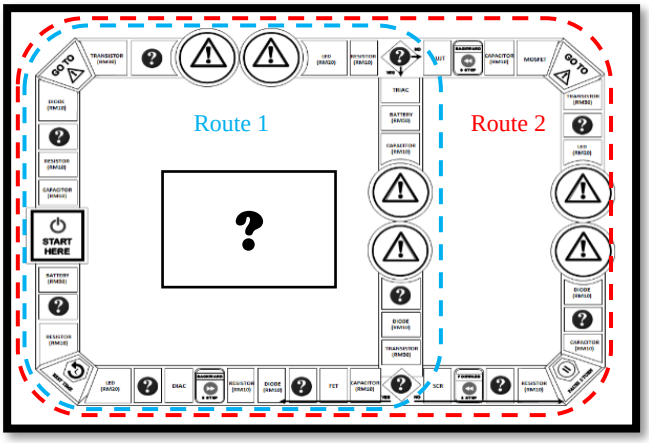

Figure 3. Route options

Each game set is equipped with a main board, support circuit board, money, pawn, dice, component pictures, question cards, warning cards, score cards and game rules. The game begins with each participant being given a circuit card, money and a pawn as markers. Each participant will roll the dice in turn, the movement of the pawn is according to the amount shown on each roll. Players will purchase components listed on the site they tread on to fill out their respective circuit cards. If players are at the question site, they need to answer the question correctly before continuing the game. Players will be fined if they stop at the warning site. Winners are selected based on circuit cards that have been equipped with all components.

Results and Discussions

A group of students from the Department of Electrical Engineering, Kuala Terengganu Polytechnic was selected to conduct a pilot test for The Components. A total of 50 students were randomly selected to conduct this pilot study. Figure 5 shows the pilot group of students using The Components.

Figure 5. Group of pilot students

Table 1. Game testing plan

Route	Test Procedure	Pre-Condition	Average time allocation for each player	Average time to complete the route
Route 1	The player moves according to the value of the dice roll and answers the given question	Correct answer; the game is continued by the same player	5 minutes	15 minutes
	The player moves according to the value of the dice roll and answers the given question	Incorrect answer; the game is continued by next player	2 minutes	10 minutes
Route 2	The player moves according to the value of the dice roll and answers the given question	Correct answer; the game is continued by the same player	5 minutes	20 minutes
	The player moves according to the value of the dice roll and answers the given question	Incorrect answer; the game is continued by next player	2 minutes	15 minutes

Table 1 shows findings from the observation during pilot test given to the pilot group.

Conclusions

The finding indicated that The Components were suggested as a teaching aid because the content and game time allocated is suitable to use during teaching and learning session. besides, the development of The Components can help students understand the basic content of electronic components through rapid learning and revision while playing. A number of outcomes, including educational knowledge, cognitive function, and physical activity, are positively impacted by the usage of board games and programmes that incorporate board games. Although there are many board games on the market, electrical engineering -based board games are very limited in the market, therefore The Components is very suitable to be promoted as one of the learning tools, especially in the field of electrical engineering. However, in order to obtain a more generalization of the results, it is suggested that the study should be extended to other polytechnics that also offer similar courses. In addition, improvements are proposed to the product such as incorporating technological elements such as AR into The Components.

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