

UNIVERSITI TEKNOLOGI MARA

**3-DIMENSIONAL VIRTUAL REALITY
GAME DESIGN FOR
DUAL COGNITIVE TASK
STROKE REHABILITATION**

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ABSTRACT

Stroke patients usually have balancing problems and walk slower than healthy people. There are two types of rehabilitation for stroke patients. It can be either a single task or dual task. A single task rehabilitation is performing one task at one time, either motor task or cognitive task. Dual task is described by completing two tasks simultaneously. In dual tasks, there are two types of tasks, which are dual-motor tasks and dual cognitive tasks. The dual cognitive tasks are a combination of a motor task and a cognitive task. Previously, the conventional rehabilitation of the dual cognitive task was performed separately. Therapists did a motor task rehabilitation then proceed to a cognitive task rehabilitation or vice versa. As stroke patients, doing dual cognitive tasks is a challenging task for them. Nowadays, it was found that using a virtual reality game for rehabilitation gives better improvement recovery than conventional rehabilitation. Based on the literature search, there is no specific game designed for rehabilitation of dual cognitive tasks for stroke patients. Current available games only focus on single task rehabilitation. Therefore, there is a need to design a new game for dual cognitive task rehabilitation for stroke patients. The benefits of using a virtual reality game are that it can inspire stroke patients to concentrate on their rehabilitation. The interactive 3-dimensional environment of the virtual reality game sometimes makes them forget that they are under rehabilitation. This study aims to explore and provide a computer-based, gamified simulation virtual reality game design for stroke patients' therapy using dual cognitive tasks. The methodological approach follows a four-phase process, namely Theoretical investigation phase, Implementation phase, Rehabilitation phase, and Evaluation phase. The theoretical investigation involves literature reviews, observation, and interviews. The implementation phase includes game design and also game development. The game theory used in the virtual reality game is the Iterate Prisoner Dilemma theory. This research was approved by the Research Ethics Committees UiTM before beginning the rehabilitation phase. For evaluation, the rehabilitation was conducted with six-stroke patients based on certain inclusion and exclusion criteria at UiTM Specialist Medical Centre Faculty of Medicine, Sg Buloh. The evaluation phase involved pre-assessment and post-assessment of sway area, stride velocity, and cadence of stroke patients. In order to design a virtual reality rehabilitation game, especially for stroke patients, it is essential to find the best dual cognitive task combination to get an improved result for all assessments. The usability test on the design of the virtual reality game for stroke patients was responded by therapists, game experts, and stroke patients. The number of respondents involved in the usability test was six stroke patients, five therapists, and five game experts. Questionnaires were used as a method for research instruments on virtual reality game usability tests. The findings showed 90 percent of positive outcomes based on a usability test of the virtual reality game application. The contribution of the study is to propose a design of an interactive 3-dimensional virtual reality game for dual cognitive tasks rehabilitation using the Interactive Cognitive-Motor Training (ICMT) technique.

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