

**DEVELOPING A USER-CENTRED COGNITIVE
APPLICATION TO IMPROVE WORKING MEMORY
FOR CHILDREN WITH LEARNING DIFFICULTIES**



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Abstract

Children with learning difficulties (LDs) often have a limited working memory (WM) capacity, meaning that they fail to meet the required amount of information needed to be processed and held while learning new skills. As soon as those children are able to overcome their WM limits, they would be able to learn as effectively as their peers.

Although there are a few existing computerized programmes to foster WM capacity, none of those programmes was designed specifically for children with LDs. Furthermore, the studies targeting cognitive training via computerized programmes focused on suggesting varied types of WM tasks rather than offering those tasks in a user-friendly way or suggesting practical guidelines targeting the end-user. Therefore, the aim of the current study is to develop a new training application to train the WM capacity of the children with (LDs). To fulfil the needs and characteristics of the target users (children with LDs), it was a must to have a set of guidelines to be followed while designing the training application. Therefore, a systematic review has been performed to derive a set of 15 guidelines. Those guidelines were incorporated into a proposed framework. This framework was created by adopting the design based-research approach, and followed clearly to design, develop, and evaluate the WM training application. The developed application is named The Treasure and consists of six gamified activities to train different WM components.

The developed application was applied on the experimental sample group (16 children with LDs) to assess its effect on their WM capacity and to evaluate their perceived experience. The semi-experimental research, interview, and unstructured observation methods were conducted. The results showed that most of the children (86.5%) perceived a good experience with the application as well as their WM performance has been improved.

In addition, the proposed framework followed to develop the application was validated via a structured interview. A set of 10 experts were interviewed to evaluate the extent to which it can be generalized for creating such cognitive applications for children. The results showed that the proposed framework can be followed easily, smoothly, and clearly to design, develop, and evaluate cognitive applications for children with LDs.

Finally, the main contributions of this study include a proposed design framework that can be followed by other researchers/designers to develop their own games/applications, a set of suggested guidelines that can be easily followed to meet the needs of children with LDs, a

pioneer application in the Arabic world to train the WM capacity of children with LDs, and recognizing the significance of the active end-user involvement in the development process of cognitive applications for those with learning differences.