EFFECTS OF DYNAMIC ASSESSMENT IN 3D IMMERSIVE VIRTUAL REALITY (3D-IVR) ENVIRONMENT ON COGNITIVE MODIFIABILITY AND THE IMPACT OF SPATIAL IVR CHARACTERISTICS

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Abstract

The main objective of this research was to study the degree to which learning process in a dynamic assessment (DA) procedure using a computerized 3D Immersive Virtual Reality (3D-IVR) contributes to cognitive modifiability (CM) of children as compared to DA in computerized 2D and in non-computerized environment. The effects of DA in these situations on children's CM were examined using analogical problem-solving from the Cognitive Modifiability Battery. DA refers to assessment - via a process of active teaching - of an individual's perception, learning, thinking, and problem-solving. DA is aimed at modifying an individual's cognitive functioning and observing subsequent changes in problem-solving patterns within the testing situation. Unlike standardized assessment, where we examine an individual's existing cognitive abilities, DA is aimed at assessing changes in performance within the test situation. Changes are taken as indications of CM. Increasing evidence indicates that practicing cognitive abilities in 3D-IVR, significantly improves cognitive achievements. We also explored the effects of 2 spatial 3D-IVR characteristics: Rotation of Information Resources (RIR) and Shift of Viewing Angles (SVA) on CM. The DA procedure included 4 phases: pre-teaching, teaching, post-teaching and a transfer tests given two weeks after teaching. The teaching phase included mediated learning experience strategies. CM was examined by pre-to post-teaching improvement and by the transfer test. Children in Grades 1 and 2 (n = 117) were randomly assigned into three experimental groups and one control group. Each of the experimental groups was given the teaching phase in a different modality: 3D-IVR (n = 36), 2D (n = 36), and Tangible Blocks (n = 24) and were compared to a control non-trained group (n = 21). The teaching phase included MLE strategies of solving analogies. The problems consisted of dimensions of color, height, number and position. Pre- and post-teaching analogies were administered to all groups followed by transfer analogies two weeks later in a non-computerized environment. The findings support our hypothesis showing that children participating in the 3D IVR environment showed the highest CM especially on the transfer problems. The conditions of the 3D IVR used synergistically with the MLE strategies in the teaching phase helped the young children to internalize the analogical operation and use it later in more difficult problems than the original analogies. The 3D IVR condition allows children to better, memorize and manipulate the information held in their mental scheme and grasp the rules of transformation by assisting them to observe a problem from a wide angle and different perspectives. The frequency of use of SVA in the computerized environments contributed significantly to CM. The IVR 3D technology presents children with possibilities of exploring the information from different angels, actively constructing and manipulating points of view and innovative perspectives, thus allowing children to assimilate the relations between the problem components and to make better deduction. CM was significantly derived from improvements in test dimensions of height and position components of the analogy which are specifically related to spatial perception. The findings are discussed in relation to the contribution of the use of computerized environments in DA, cognitive maps formation and cognitive performance.

Keywords: 3D-IVR, Dynamic assessment, Mediated learning, Cognitive modifiability.