AUGMENTED REALITY REMEDIAL WORKSHEET FOR NEGATIVE NUMBERS SUBTRACTION OPERATION

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ABSTRACT

Integration of Information Technology and Communications (ICT) with Mathematics remedial education faces new challenges and responsibilities to develop tools that would allow students in the 21st century to relearn topics they find difficult to understand effectively. The integration of ICT with education has seen the emergence of new technologies such as Augmented Reality (AR), which allows learners to view the real world with additional information through computer in 3D images or objects. Therefore, this study was conducted based on two objectives: to design and develop a remedial system by integrating a tangible Remedial Worksheet for negative numbers through AR technology called AR^2WN^2; to conduct a usability testing on AR^2WN^2 based on five constructs: learnability, effectiveness, ease of use, flexibility, and attitude of remedial learners towards the system. AR^2WN^2 constitutes three learning environments: tangible (Remedial Worksheet), digital (with components such as History, Functionality, Diagnostic Assessment, AR Remedial Activity & Learning Game) and Hybrid (Remedial Worksheet & AR Remedial Activity), in the real environment by integrating aspects on meta-cognition, information processing and constructivist learning approach. The system was designed to help learners correct their thinking process on negative numbers through self-paced, self-based and self-controlled corrective learning approach. In a nutshell, for the usability testing, the findings showed that learners accepted AR^2WN^2 as suitable in fulfilling the needs of learners through self remediation process. Moreover, AR^2WN^2 was successful in helping learners involved in the study to correct their respective misconceptions on negative numbers. However, the time taken to adopt correct thinking process varied based on misconception types and remedial learners tested from half an hour to two hours. The research contributions are as follows: (i) the design and development model based on the Iterative – Participatory Development Life Cycle of Augmented Reality Remedial Worksheet for Negative Numbers (IP-AR^2WN^2), (ii) the design of AR Remedial Worksheet Instructional Design model (ID) for Negative Numbers focusing on remedial learners' requirement specifications and system design specifications, (iii) scaffolding model for remedial on negative numbers, (iv) instruments for usability testing study (HIS-MCL, JOB-MCL, DA-MCL, RW-MCL, HYB-MCL, & LG-MCL) and (v) findings on the outcome of the usability testing on AR^2WN^2 system.