

Lecture Notes in Educational Technology

Mohd Fakhizan bin Romlie  
Siti Haryani Shaikh Ali  
Zolman Bin Hari  
Meng Chew Leow *Editors*

# Proceedings of the International Conference on Advancing and Redesigning Education 2023

ICARE 2023

 Springer

# Lecture Notes in Educational Technology

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## **Introduction to ICARE 2023**

International Conference on Advancing and Redesigning Education 2023 (ICARE 2023) is a two-day conference hosted at Universiti Teknologi PETRONAS by the Alliance of Government-Linked Universities in collaboration with Majlis Ketua-ketua E-pembelajaran IPTA Malaysia (MEIPTA).

The objective of ICARE 2023 is to establish collaboration opportunities with an emphasis on relationship building between the academic and the industry. It also aims to strengthen the research culture among educators, specifically in the Teaching and Learning areas.

ICARE 2023 featured a variety of forums and keynote speeches by internationally recognised speakers under the theme “Reshaping Future Education through Digital Transformation”.

## Foreword

I extend a warm welcome to all participants of the International Conference on Advancing and Redesigning Education (ICARE 2023). It is always invigorating when respected speakers, delegates, and attendees come together to champion a noble cause, as the results have the potential to positively reshape the destiny of humanity.

This event is a collaborative effort of the Alliance of Government-Linked Universities (GLU) siblings, which include Multimedia University (MMU), Universiti Kuala Lumpur (UniKL), Universiti Tenaga Nasional (UNITEN), and Universiti Teknologi PETRONAS (UTP) and our organiser by Majlis Ketua-Ketua e-pembelajaran IPTA Malaysia (MEIPTA). I am eagerly anticipating the outcomes of this conference due to this joint effort.

In the present day, the world faces numerous uncertainties and challenges including economic instability, increasingly troublesome environmental conditions, and humanitarian crises. However, this complex global landscape has also acted as a catalyst for uncovering unexplored opportunities and possibilities, particularly for higher education. It is imperative for us as educators to consistently prepare our students to thrive in a new era by immersing them in future scenarios, facilitating change, and empowering future generations.

This significant conference is timely organised as it aims to explore innovative technologies and ideas to effectively address these challenges and provide practical solutions to the communities we serve. With the theme of 'Reshaping Future Education through Digital Transformation', I am confident that ICARE 2023's goal of fostering collaboration between academia and industry with a focus on relationship building will be fully realised. This event will also foster a research culture, particularly in the Teaching and Learning areas, among educators. I hope that the conference and the compelling topics we have prepared will unlock new perspectives that enable us to re-imagine the future in light of global trends.

I would like to express my deepest gratitude to UTP, the host of the conference which has worked tirelessly to make this event a success, our other esteemed GLU partners, our co-organiser MEIPTA, and the conference sponsors for their pivotal role in ensuring the success of this event.

To all the speakers, delegates, and participants of ICARE 2023, your unwavering support for this event is an invaluable contribution to our mission of creating a better tomorrow.

Thank you.

Professor Dato' Dr Mazliham Mohd Su'ud

Chairman of Alliance of Government-Linked Universities

President and Chief Executive Officer, Multimedia University.

## Foreword

This is the second series of International Conference on Advancing and Redesigning Education 2023 (ICARE 2023) by the Government-Linked Universities (GLU), hosted by Universiti Teknologi PETRONAS (UTP), in collaboration with Universiti Tenaga Nasional (UNITEN), Multimedia University (MMU), and Universiti Kuala Lumpur (UniKL) and co-organised by Majlis Ketua-ketua E-Pembelajaran IPTA Malaysia (MEIPTA).

Through our partnership and collective efforts, we hope to expand impact through a platform for educators to share their best practices as well as gain insights from other initiatives in Teaching and Learning, assisted by digital technology.

The theme “Reshaping Future Education Through Digital Transformation” is apt considering how the post-pandemic has catalysed the wave of digital disruptions, which is driven by rapid technological advancements. The democratisation of access to high-quality education through digital disruptions has made digital and media literacy, along with the capacity to adjust and embrace new learning trends, increasingly important.

Indeed, Higher Education Institutions need to prepare themselves for the future learners, who are no longer the digital natives, but rather, the AI natives. Curriculum therefore needs to be more engaging, and interdisciplinary, promoting digital collaboration and digital literacy to meet future market requirements.

Education is not just about imparting knowledge, but it is about fostering collaborations, critical thinking, and enhancing students’ learning experiences by leveraging on technology, thus promoting the pathway for innovations in teaching and learning. Thus, ICARE is here for educators to share their ideas, reflecting on their practices and their teaching philosophies in creating and promoting an effective learning environment for all learners, that will benefit not just the learners but the community at large.

My heartiest appreciation goes to all the sponsors and my focus recognition and thank you to all who have contributed to ICARE’2023. Let us work together to bring positive changes to the community and the nation.

Thank you and have an enriching and impactful conference.

Professor Dato’ Ts. Dr Mohamed Ibrahim Abdul Mutalib

Vice-Chancellor, Universiti Teknologi PETRONAS



# Foreword

There has never been a more critical time to focus on using educational technology in higher education. Universities worldwide learned the benefits and challenges of using technology to teach, learn, and assess during COVID-19. If technology is thoughtfully implemented and focuses on learning, teaching, and assessment, the student experience is enhanced. We can reconceptualise education, redesign our future, and reshape the student experience. The online environment provides another space where good teaching and learning can occur. Students learned to interact in the online environment, and teachers developed their digital literacy in teaching and assessing online. However, universities cannot do this alone; this book provides a role model for collaboration. The following Government-Linked Universities (GLU) collaborated on organising a conference to examine advancing and redesigning education. These include Universiti Teknologi PETRONAS (UTP), Universiti Tenaga Nasional (UNITEN), Multimedia University (MMU), and Universiti Kuala Lumpur (UniKL).

Another critical theme in higher education, as mentioned by the Educause Horizon Report 2023, is that “our shared humanity has also become a key focal point within higher education, as faculty and leaders continue to wrestle with understanding and meeting the diverse needs of students and to find ways of cultivating institutional communities that support student well-being and belonging” (Educause Horizon Report, 2023, p. 4). In particular, Universities need to be aware that the post-pandemic educational context includes

- Student demand for flexible learning

- The online versus face-to-face dichotomy is being disrupted

- The need and demand for lifelong and workplace learning are increasing

- The potential for AI to become mainstream is growing (Educause Horizon Report, 2023).

This book is a compilation of conference papers presented at the International Conference on Advancing and Redesigning Education 2023. This event gathered leading experts, researchers, and practitioners to discuss and showcase the latest developments in education and technology. Close to 100 papers were part of the proceedings, and it is heartening to see the emphasis throughout the conference. A glimpse through keywords in the generative cloud word below shows learning, students and education as key themes. It is not unexpected but essential to never lose sight of what we are trying to achieve, particularly when technology and educational technology are used.

The book covers a diverse range of topics and delves into four primary areas of focus:

## **Technology-Enhanced Learning**

This section explores innovative ways technology shapes the learning landscape. It examines how digital technologies facilitate learning, teaching, and assessment. Blended or online courses and learning management systems assist this process. There may be synchronous (real time) and asynchronous (e.g. pre-recorded materials) learning. Mobile

learning can also provide flexible, accessible educational options. Technology-enhanced learning can enhance engagement and promote self-directed learning.

### **Innovative Curriculum and Program Offering**

This section examines novel curriculum design and development approaches. Curriculum needs to be designed to empower students with knowledge, skills, and capabilities to thrive in a changing world. Interdisciplinary learning provides holistic learning. Project-based learning assists in solving real-world problems. Others include personalised learning pathways and programs that emphasise a global perspective and the development of transferable skills.

### **Learning Beyond the Classroom**

This section Investigates the expanding boundaries of learning experiences beyond traditional classroom settings. These settings may include environments outside the usual boundaries of the campus. They may consist of community engagement, involvement in industry projects, travel and immersion in another culture, extracurricular activities that involve activities like clubs, sports, arts and community service, online learning, internships, fieldwork, and volunteering. Education needs to be considered as a lifelong journey.

### **Digital Campus**

This section analyses the role of digital technologies in transforming educational institutions. The digital campus can vary from institution to institution and depends on the strategy and technology infrastructure. The aim is to utilise technology to enhance the student experience. Aspects of the digital campus may include online learning, learning management systems, virtual classrooms, e-libraries, communication tools such as email, mobile apps, simulations, and data analytics.

Professor Mike Keppell

Former Pro Vice-Chancellor, Learning Transformations, Swinburne University of Technology

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# Towards a Conceptual Design Framework for Virtual Reality-Based Educational Animations

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**Abstract.** Virtual reality-based educational animations are one of the ways educators provide instructional guidance and knowledge. Even though virtual reality-based educational animations offer a range of learning opportunities, they need more major instructional guidance, making it more challenging to generate learning material that adheres to education curriculum and context. Thus, this study attempts to (a) identify various learning theories and design principles and (b) propose a conceptual design framework for virtual reality-based educational animation for learning. The proposed conceptual design framework for virtual reality-based educational animations is explored in this study.

**Keywords:** Animation · Educational Animation · Conceptual Design Framework · Virtual Reality-based Learning

## 1 Introduction

The phrase “Virtual Reality” (VR) has several different definitions. This may be due to the interdisciplinary nature of VR research since many concepts were borrowed from other disciplines, such as psychology and cognitive science [1]. As modern applications use VR, logic breakthroughs have made it possible to create a new style of learning that better suits the needs of the 21st-century learner, who desires entertainment, interactivity, involvement, and object manipulation [2]. For example, recent reviews showcase articles published involving countries worldwide; the European Union and the United States are the primary research centers of these technologies. Most papers can also be categorized into four categories: research and development, healthcare, education, and industry [3]. As a result, researchers have found that virtual reality offers an engaging method and motivates students to participate in their education. It is also appropriate for students who think more schematically and visually; it gives them a general understanding of the subject, helps them apply new information, and makes it simpler and faster for them to comprehend the course they have studied [4].

The numerous somewhat variable and heterogeneous definitions of VR in the literature demonstrate the lack of uniformity or consistency; consequently, as the number of

related terminologies continues to grow and expand, a request for precise definitions of VR has become increasingly important [5]. There are thus many definitions from which VR might be deduced. Yet, the most comprehensive definition of VR is a real-world or computer-generated environment in which a perceiver feels telepresent [6].

This definition was chosen because it isolates the impact of technology and focuses on the strategy and uses for the present advancement of technology [3]. Additionally, according to technological advances over time and dynamic interpretations of society, the definition of virtual simulation today is as follows: virtual simulation is a strategy for encouraging a perceived live experience for a desired outcome through partial immersion in a digital learning environment [7].

VR has been extensively experimented with, but educators face challenges creating virtual environments due to learning objectives and staying up-to-date with rapidly evolving technology [8]. Moreover, according to Berney & Bétrancourt (2016) [9], research now explores the cognitive mechanisms involved in processing dynamic vision and the procedures that eventually result in learning” (p. 151). It is not uncommon that learning theories are frequently neglected when designing VR applications, with a greater emphasis placed on the design and usability of the VR application. The call for evidence-based design decisions is much needed with the advancement of readily available instructional technologies and the availability of virtual-based instructional material [10, 11]. Moreover, VR offers diverse learning opportunities but lacks instructional design, making it challenging to align with education syllabuses [12]. Thus, the framework provides a robust structural base, superb design, and simple problem-solving [13, 14].

This study explores germane learning theories and design principles that can be integrated into a conceptual design framework suitable for educational animation for virtual reality-based learning. To delve further, the researchers need to (a) identify various learning theories and design principles and (b) propose a conceptual design framework for virtual reality-based educational animation for learning.

## 2 Conceptual Design Framework

Through reviewing the literature in the area, several learning theories and design principles are selected: Virtual Reality Principles, Virtual Reality-based Learning Principles, Mayer’s Multimedia Principles, and Cognitive Requirements for Learning. They are as follows:

### 2.1 Virtual Reality Principles

Virtual reality system comprises input devices, output devices, and simulated situations. Table 1 showcases six essential components for application development [15, 16]:

### 2.2 Virtual Reality-Based Learning

The term “Virtual Reality-enable learning” was used by C. Li & Ip (2022) [17] to characterize virtual reality’s use in education. This word better describes *technology’s role in*

**Table 1.** Essential principles for virtual reality

Characteristic	Definition
Interaction	Principles explore technology-human interaction through multisensory interfaces
Virtual technologies	User movements are captured instantly, allowing avatars to engage in the virtual world
Perception & Immersion	Utilizing the immersion concept to evaluate user presence in a virtual environment
Multi-sensory interaction	Human senses and the relationship between virtual reality are addressed by optimized technological design
Navigation	Virtual navigation involves controlling avatar motion using technologies
Virtual Mockup	Virtual prototyping involves product design, review, and evaluation

learning. Thus, this study came to five significant conclusions about VR-enabled learning. As seen in Table 2, the first two of the columns are concerned with the technological and psychological components of the VR experience, while the remaining three are concerned with learning [17]:

### 2.3 Mayer's Multimedia Principles

Mayer's multimedia principles developed by Richard E. Mayer are well-known in the field of multimedia learning and instructional design. These principles, based on cognitive psychology research, attempt to guide the successful use of multimedia in educational environments [20, 21]. The fundamental principles are as follows (Table 3):

### 2.4 Cognitive Requirement for Learning

Mayer's Multimedia Principles (MMP) lead many current researchers on multimedia learning efficacy [22–25]. Mayer's analysis also suggests three goals for multimedia design lessons: (a) eliminating unnecessary processing, (b) regulating critical processing, and (c) encouraging generative processing [26]. There are three cognitive capacity requirements for learners in Table 4:

Table 5 displays three pedagogical situations: extraneous overload, essential overload, and generative underuse. Extraneous overload hinders learners' ability to participate in essential and generative processing, essential overload exceeds learners' cognitive abilities, and generative underuse results from dull instructional videos.

## 3 Discussion

To propose a conceptual design framework for Virtual Reality-based educational animations, the fundamental principle of VR, Mayer's Multimedia Principles, and Virtual Reality-based learning principles are crucial when fulfilling the learner's cognitive

**Table 2.** Characteristic virtual reality-enabled learning

Characteristic	Definition
Immersion	A virtual environment should allow user-virtual or multi-user interactions to create a completely mediated experience—the researchers C. Li and Ip (2022) propose reporting virtual environments’ technological capabilities by including sensory stimulation supply and interaction facilitation
Presence	Steuer (1992) defines presence as “being there”[6]. Even if presence is subjective, the study on VR-enabled learning must determine if increasing presence constantly improves learning efficacy [17]. Future VR learning studies should quantify presence, a fundamental VR concept
Pedagogy	A few standard educational strategies have been revised to complement learning activities in VR or outside VR. Inquiry-based, problem-based, and experiential learning are examples [17]
Targeted Learning Outcomes	Precise definitions of learning outcomes can help distinguish VR-enabled learning from VR entertainment. According to affective learning theory [18], using VR in educational settings to develop youth’s intercultural sensitivity positively impacts learners
Learner Specific	Learner details may include age, gender, and learning style [17]. Learning style and its models are crucial to understanding people’s learning [19]

requirements (refer to Fig. 1). Then the overall design should follow Mayer’s cognitive capacity requirements to match learners’ cognitive processing abilities. VR concepts emphasize maximizing multi-sensory interfaces, capturing avatar navigation and movement, and incorporating product research, analysis, and design. On the other hand, Multimedia Principles seek to improve comprehension and learning in multimedia presentations while fostering deep learning and optimizing knowledge transfer for successful, engaging, and lasting learning experiences. In addition, VR technology is used in immersive learning, or VR-enabled learning, to enhance the learning experience. Thus, Virtual Reality-enabled learning generally enriches education by providing immersive, interactive, and engaging learning experiences that improve information retention across various disciplines and subjects. Finally, all the principles must consider Mayer’s cognitive capacity requirement, which states that educational materials should be created to correspond with students’ cognitive processing capacities. This will assist learners in concentrating on vital information without interruptions by minimizing cognitive load.



**Table 3.** Mayer's multimedia principles

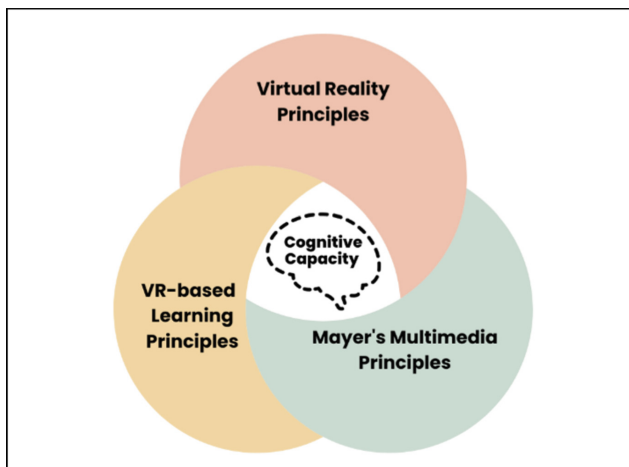
Principles	Definition
Multimedia	Words and visuals improve learning. Photos, animations, and explanatory text can improve learning and recall
Modality	Multimedia that matches the learner's senses helps information stick. Complex visual information may be better understood through animations or video, whereas procedural knowledge may be better conveyed through audio narration
Coherence	Multimedia presentations should avoid unnecessary content. Distracting pictures or music might impede student learning
Redundancy	Avoid duplicating text and audio. Repetition may impair learning
Contiguity	Show spatial or temporal relationships with similar words and images. Associating knowledge reduces cognitive load and increases comprehension
Personalization	Conversational language and personal pronouns enhance learning by establishing instructor presence
Segmenting	To assist students in understanding complex material, break it into smaller portions
Pre-Training	Accessing existing knowledge before a multimedia session improves learning outcomes
Signaling	Arrows and highlighting focus students' attention to important material
Practice & Feedback	Practice and feedback encourage learning and skill development

**Table 4.** Cognitive capacity requirement

Processing	Description
Extraneous	Processing that does not support the educational goal
Essential	Processing intended to help the reader retain the key information being provided
Generative Processing	Intended to make sense of the information

**Table 5.** Pedagogical Situations

<b>Extraneous Overload: Too Much Extraneous Processing</b>			
Required	Extraneous	Essential	Generative
Available	Cognitive Capacity		
<b>Essential Overload: Too Much Essential Processing</b>			
Required	Essential		Generative
Available	Cognitive Capacity		
<b>Generative Underutilization: Not Enough Generative Processing</b>			
Required	Essential		Generative
Available	Cognitive Capacity		

**Fig. 1.** Diagram of the Conceptual Design Framework.

## 4 Conclusion

With ever-expanding progress in VR technology and methods, guidelines such as a design framework can aid VR educational animation development. Educators can utilize design frameworks to decrease creative decision-making and enhance learning objectives to produce valuable instructional resources for various areas. Still, more study is required to improve and evaluate its potential. This design framework for virtual reality-based educational animation can support educators in producing a VR-based educational animation. A uniquely designed conceptual framework for virtual reality-based educational animation will successfully support educators or instructors in expanding and visualizing the learning target. With the current ever-expanding progress in virtual reality technology and methods, guidelines are becoming more important to refer to, as it will assist

in maintaining efficiency during development, and it is critical for instructors to prepare instructional aspects and their integration so that students can achieve a defined goal on their own.

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