

***Instructional Design Model of Virtual Reality Digital Integration:
An Experimental Case Study in Managerial Control Education***

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Abstract

Virtual reality immersive learning technology is widely recognised for offering the potential for fully immersive environments that can enhance learners' cognitive development. This paper introduces instructional guidelines for the creation and integration into the learning design of pedagogically structured virtual reality digital content to support cognitive learning. The learning prototype created for the study simulates a series of situated work-life scenarios where the learners must reflect on their behavioural intentions in response to socio-cognitive conflicts encountered during learners' creation of their knowledge. A learning management system and an immersive virtual reality learning platform support the virtual constructivist learning environment. The learning prototype constitutes a valuable tool for researchers aiming to demonstrate that immersion in a reality-based environment, engagement with complex and ambiguous situations and information, and interaction with space can significantly enhance learning performance. This study features a management accounting course where learners prepare a dashboard of performance indicators for a business organisation.

Keywords: Situated Cognition, Immersive Learning, Virtual Reality

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Introduction

Several studies have examined the effects of situated learning on knowledge acquisition and evidenced that learning in situated environments makes knowledge transfer more efficient and facilitates the acquisition of transferable knowledge in real-life contexts. The core assumption of situated cognition is that learning inherently ties to the social and cultural contexts in which it occurs. Immersion in a virtual environment, engagement with complex and ambiguous situations and information, and interaction with space can significantly enhance learning performance. Zheng (2010) compared learning performance between situated and traditional learning and found a positive correlation between situated learning and learner performance.

Situated cognition represents another challenge for instructional designers and educators because it requires balancing what is known and what is currently being experienced (the incoming information and new knowledge). Existing literature on socio-cognitive conflicts suggests that learners demonstrate various types of behavioral intentions in response to socio-cognitive conflicts when learners interact in groups to develop new knowledge (Cheng, 2014).

Conflict regulation is defined as the meaning people attribute to conflict when facing another's idea that contradicts their own. It determines the conditions under which confronting diverging ideas results in positive cognitive and relational outcomes (Darnon, 2019). Darnon (2019) argued that socio-cognitive conflicts benefit learning because conflict is regulated through specific mechanisms to ensure that the conditions under which confronting diverging ideas results in positive cognitive and relational outcomes are met. Truhlar (2018) investigated the factors that influence students' engagement in synchronous online discussions and found that assigning roles increases the proportion of critical student–student interactions.

Research Background

In managerial control and accounting, scholars have claimed that more research should be conducted to examine the integration of management accounting and psychology. Hall (2016) argued that focusing on the individual level and dynamic perspectives is necessary to drive further theoretical developments in management accounting research. He said: “A prominent feature of organizational-level studies is the lack of explicit attempts to theorize the psychological processes through which management accounting practices are expected to influence individual behaviour and, in turn, how individual behavior is expected to combine to influence organizational-level outcomes such as organisational performance” (p. 66). Research in contingency-based management accounting has evidenced that Managerial Control Systems (MCS) lie on a continuum between two alternative models of transactional or relational types, representing an organisation's dominant behavioural orientations or preferences. Townley et al. (2013) argued that performance measurement should integrate two dimensions of rationalization in social action: communicative rationality (the pursuit of reason in human affairs) on the one hand, which brings to light the justifications by which actions and policies are pursued, and rationalisation on the other hand (which represents the cognitive dimension of instrumental rationality to specify the means and ends of organizational actions and activities). The combination of the ‘interplay’ of those two dimensions constitutes an essential factor in constructing performance systems.

Research Objectives

Our study aims to develop a learning prototype, called *MPP business simulation*, to help design a learning process and propose an underlying socio-cognitive model of the twin dimensions of rationality in social action explained above to support the design of the learning process. In the *MPP business simulation*, learners prepare a dashboard of performance indicators and encounter a series of real-life scenarios to support cognitive learning in constructing performance measures. Those scenarios are intended to simulate situations where learners respond to socio-cognitive conflicts by adopting different types of behavioral intentions. The learning process reflects the interplay between instrumental and communicative rationality in social action which is necessary. Those scenarios are supported by immersive learning environments combining a dual infrastructure of a Learning Management System (LMS) and a Virtual Reality (VR) technology platform.

Learning Prototype

In the *MPP business simulation*, learners prepare a dashboard of performance indicators by encountering a series of situated scenarios supported by the Virtual Reality platform to enhance learners' cognitive development. Cognitive learning is driven by learners' behavioural intentions in response to socio-cognitive conflicts when learners interact in groups through knowledge construction. Participants are invited to answer questionnaires on their behavioural intentions before interacting in meetings with other participants and reflecting on their behavioural learning styles. They are also invited to receive feedback and guidance from mentors to assist and give advice on preparing for meetings. Situated scenarios in a structured learning process supported by a dual infrastructure of an LMS and a VR technology platform greatly help to enhance cognition among learners in the process of knowledge construction of performance measures.

The pedagogical approach employs a multi-faceted viewpoint encompassing the learning environment, processes, tasks, socio-cognitive, technological aspects, and learning design. Forum discussion allows learners to engage and discuss online to get answers to their questions or corresponding feedback. Interactions with fictitious roles like *MPP CEO Office* or *MPP CFO Office* cannot be supported in real-time in the VR platform via avatars but are made possible by using discussion forums in the LMS on an asynchronous basis. Those activities aim to facilitate feedback and advice to project teams along the different preparation steps of their business case. Correspondingly, the objective of feedback sessions is to facilitate the process of data requests in *MPP business simulation*. Figure 1. Below is an example of a situated scenario.

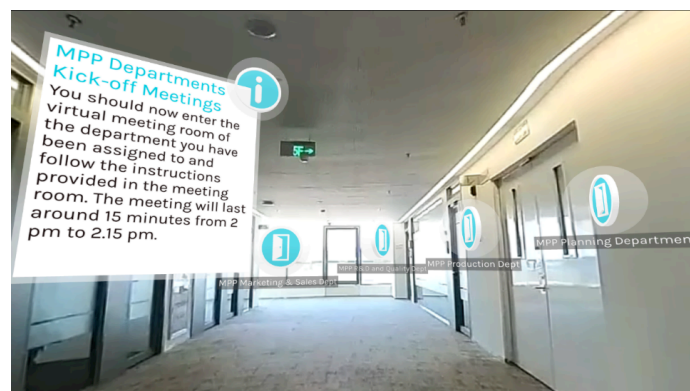


Figure 1: Situated Scenario (Department Meeting Virtual Space)

Socio-cognitive Model

The socio-cognitive model underlying the instructional design strategy and learning process design is based on the central assumption that the construction of performance measures should embed ‘socially constructed’ two opposite dimensions as part of the same rationalization process: reasoned justification and instrumental mastery. Fig 2 below describes this model.

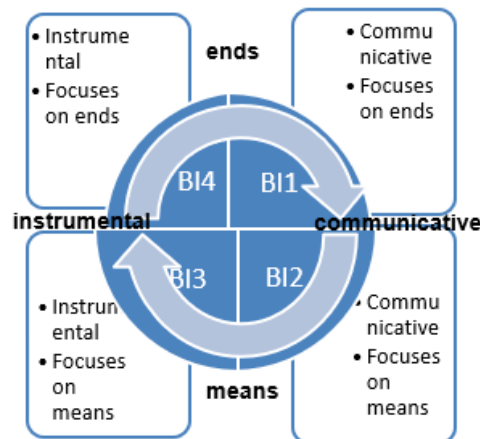


Figure 2: Socio-cognitive Model

Research Avenues

It is suggested that the socio-cognitive model underlying the instructional design strategy and learning process design could be investigated further through a series of scenario-based experiments to test a causality model to determine psychological determinants of collaborative behaviours in knowledge construction of performance measures. The purpose is to determine psychological factors influencing collective behaviors when individuals participate in the construction of a set of performance measures (performance dashboard) for a business organisation. The experiment is conducted in three steps. At each step, all students are asked to complete survey questionnaires to measure their behavioural intentions and the antecedents' variables to those intentions. Those questionnaires are completed in around ten minutes right before the start of three specific types of learning activities (virtual meetings), which are critical to constructing performance measures in terms of social interaction. When answering the questionnaires, participants are presented with short scenarios and asked to indicate how they would prefer to respond to the scene and how they would prefer to interact with other participants. Those short scenarios replicate the same situations and context that participants would encounter in the learning activity right after answering the questionnaire to ensure that their responses are consistent with the context in which students are immersed. In the next step, students from the experimental group must attend learning activities to change their attitudes and perceptions of social norms (treatment). Those learning activities are supposed to help students reflect on their learning experience and understand the reasons and benefits of collaboratively engaging in the learning activities. The originality of the experiments relies on a particular research design using a Virtual Constructivist Learning Environment.

Conclusions

Tycho (2021) acknowledged a dearth of practical guidelines for learning design in immersive environments. *MPP business simulation* learning prototype attempts to bridge this gap, by advancing the field of instructional design and helping to formulate strategies, methodologies, and tools for cognitive learning vital for the success of immersive educational environments.

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