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KNOWLEDGE CONSTRUCTS IN DISCRETE AND CONTINUOUS SIMULATION

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ABSTRACT

Since the early development of computer simulation, knowledge constructs have played a major role in model construction and simulation analysis. This is the case for both discrete and continuous simulation. This study is an ongoing effort to explore the development and utilization of knowledge and information constructs in modeling and simulation. Effective knowledge management is the key to the success of every complex organization. This study hopes to improve the knowledge transfer potential of modeling and simulation through an investigation of the primary knowledge constructs used in simulation models. This can lead to improvements in teaching modeling and simulation and contribute to the broader knowledge management process.

1 INTRODUCTION AND METHODOLOGY

The current effort builds on earlier work by the author on knowledge management and system dynamics (Trimble & Fey 1992) as well as curriculum development in simulation (Trimble 1997, 1999). System dynamics is the approach to continuous simulation that is examined in this study. Knowledge management addresses: knowledge acquisition, knowledge creation, building knowledge repositories, accessing knowledge, and assessing the value of knowledge. An effective knowledge management system evolves with changes in the organization and its environment, particularly with advances in technology. Knowledge management plays an increasingly important role in organizations. Knowledge management is essential in addressing the complexity that is a natural aspect of all large systems and organizations.

Modeling and simulation have proven to be very useful in advancing the decision making process in complex situations. Discrete simulation has drawn on statistical analysis while system dynamics brings awareness to feedback and delay Modeling and simulation can make an important contribution to developing learning organizations. This requires ongoing utilization of simulation models and thorough and assessable documentation of the outcomes of these modeling exercises. This can best be achieved with a comprehensive approach to knowledge management. Early simulation modeling relied on text-based languages that had limited capabilities. This limited simulation model knowledge constructs. Advances in simulation included the development of icon-based languages such as Stella and iThink, Arena, and Extend. This made it easier to document the stock and flow representation of SD models and the entity flow transitions in discrete simulation as well as graphical results of all models. The knowledge constructs that are the focus of this project appear in Table 1 below.

System dynamics knowledge constructs	Discrete simulation knowledge constructs
Stock and flow diagrams	Key entities and their stochastic performance
Causal loop diagrams	Resources and their stochastic characteristics
Resource state tables	Input models
Subsystem diagrams	Output representation for terminating systems
Model boundary charts	Output representation for steady-state systems
Graphs of dynamic changes in key variables	Comparisons of multiple system designs

Table 1: Knowledge constructs in modeling and simulation

2 DISCUSSION AND RESULTS

(Barnes & Milton, 2015) points out "One of the biggest benefits of any KM system is making knowledge and experience available to the rest of the organization." Most organizations are faced with a situation of information overload. To confront and deal with this situation there is a need to systematically deal with the collecting, assessing and organizing of information and knowledge. The effective handling of an organization's knowledge management system requires a regular reassessment of their approach to the generation and handling of knowledge. Without a dynamic KM system the loss of critical knowledge is an ongoing organizational problem. (Leonard et al 2015) reported that a survey of executives indicated that 97% responded yes when asked 'Does your organization need to transfer business-critical expertise?' and 78% indicated that loss of expertise is more of an issue now than it was five years ago.

It is in this context that this study hopes to improve upon the use of simulation in the knowledge management context. The improvement will address two processes. The instructional approach to modeling and simulation will be examined through the lens of several of the more popular textbooks used over the years to teach simulation (Kelton et al 2015, Sterman 2000). Secondly, an effort will be made to develop a framework to address the integration of SD knowledge constructs into a KM methodology. This will be built on previous efforts (Trimble & Jenkins 2012) that focus complexity in knowledge management.

3 CONCLUSIONS

The intended outcomes of this project are 1) a pedagogical style linking the use of simulation models and knowledge management that will be useful in a number of courses; and 2) a framework addressing simulation knowledge constructs that will aid the knowledge management process in a range of organizations.

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