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Modeling a learning organization using a molecular network framework

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ABSTRACT

In this paper we present a new approach for modeling a learning organization using molecular network framework. For the purpose of this study, we have developed a new FUTURE-O-DYN model for simulation of learning organization by combining the FUTURE-O^o model, a comprehensive model that through the seven elements leads to a fully-fledged learning organization, with molecular dynamics simulation technique. Molecular dynamics simulation, in which the classical equations of motion for all particles of a system are integrated over finite period of time, provides an important insight into the structure and function of molecules. The resulting trajectory is used to compute the time-dependent properties of the system. Here, we apply molecular dynamics, in particular free energy simulation, to simulate a learning organization or any other system including the use of computer technology in educational process. All steps of modeling process; from data preparation to development of a suitable simulation space, potential energy function and parameters to carry out simulations of a learning organization are discussed. Major achievement of this study is that we apply molecular dynamics technique to model a learning organization consisting of two individuals, which is done for the first time, with the newly developed FUTURE-O-DYN model. For this purpose we also developed parameters that define potential energy function for a pair of programmers case described in the literature. In our model, the free energy is proportional to the values of the seven elements in the FUTURE-O^o model. The simulation results indicate that the calculated free energies using FUTURE-O-DYN model are in excellent agreement with the experimentally measured values. The approach described here is general and applicable to any education, business or corporate based learning organization.

1. Introduction

In the turbulent and volatile business environment today successful organizations require sharp vision, rapid pace along with ability to transform quickly in reaction to changes in the environment. Flexible structure of organizations is more preferred today over traditional hierarchical structure due to its capacity to transform and adaptability. The organization, which is based on a strict hierarchy with high leveling structure, centralized decision-making, high formalization and inflexibility, because of its rigidity, cannot respond to changes in the environment.

Modern learning organization builds sustainable competitive advantages on knowledge and intellectual capital which are their only economic resource. Learning organization is an ideal form of an organization. A learning organization is a place where the beliefs, values and norms of employees are brought to bear in support of sustained learning; where a “learning atmosphere”, “learning

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culture” or “learning climate” is nurtured; and where “learning to learn” is essential for everyone involved. Learning organization envisions change, is committed to generating new knowledge and innovation, and has learned how to learn. A learning organization has a structure that improves itself by making it easier for its employees to learn. Hence, for all organizations, education, business or corporate based to respond successfully to contemporary challenges of fast changing environments it is best to transform to a learning organization (Dimovski, Penger, Skerlevaj, & Znidarsic, 2005; Senge et al., 1999; Senge, 1990, 2014).

Learning organization differs largely from its counterpart classical organization in systematic problem solving, systematic prospecting, extraction and testing of new knowledge into practice, learning from its own past successes and failures, learning from foreign experience and rapid and effective transfer of knowledge throughout the organization. According to Garvin (1985) this is one organization that knows how to create, acquire, interpret, transmit and retain knowledge and deliberately change its behavior in order to be able to use their new skills and knowledge. The link between management orientation such as learning organization and sustainability of the organization has been extensively studied (Chen, 2010; Cheng, Wang, Moormann, Olaniran, & Chen, 2012; Jamali, 2006).

Several types of learning organizations exist. Much is known about private organizations as learning organizations and less about the public institutions, mainly higher education institutions or universities (Bui & Baruch, 2012). A growing body of scholars, educators and policy makers is making the case that schools should be re-conceptualized as “learning organizations” that can react more quickly to changing external environments, embrace innovations in internal organization, and ultimately improve student outcomes. So even in the domain of higher education, which includes some of the oldest, most traditional types of organizations in the world, the external environment is changing. Unless colleges and universities adapt, their tradition may not last, at least not for centuries they have in the past (Burke, 2014). The organizations endowed with learning capabilities (White & Weathersby, 2005) enable higher education institutions to their internal and external environment by facilitating the required changing or transformations and developments in organizations. Despite strong support for and the intuitive appeal of the school as a learning organization, relatively little progress has been made in advancing the concept, either in research or practice. This lack of progress partly stems from a lack of clarity or common understanding of the school as learning organization.

The external environment is the main driver for change as it continues to advance more rapidly than the organizations. Problems arise internally and are related to interactions and relationships between elements such as leadership and strategy upon the workings of the organization (Burke, 2014). In this respect universities are no different than any other business or organization but where they do differ significantly is that they do not exist to make money for shareholders. They exist to generate for the betterment of society. Therefore they have a greater responsibility to learn effectively in order to meet their social obligations (Bowen & Schwartz, 2005).

Higher education institutions no longer exist exclusively in the non-profit sector. Therefore they have to go through organizational change requirements (Burke, 2014). Higher education institutions are increasingly starting to view organizational learning interventions as an important means to better understand how knowledge is managed and used (Kidwell, Vander Linde, & Johnson, 2000; Metaxiotis & Psarras, 2003; Rowley, 2000; Solanki, 2013). This research seeks to understand whether the application of the tools and techniques associated with organizational learning can be of benefit to higher education and this provides one additional perspective to the growing body of literature concerned with the management of organizational knowledge.

Both the learning organization and organizational learning are very similar in that they connect to each other, but differ in that one involves the actual learning in an organization and the other involves the course of gaining the learning in the organization. Organizational Learning is defined as “the process of improving actions through better knowledge and understanding” (Fiol & Lyles, 1985). The learning organization is classified as “organizational learning that is the activity and the process by which organizations eventually reach the ideal of a learning organization” (Smith, 2001). The learning organization and organizational learning are slightly different in that the learning organization is the process to change and organizational learning is having the process and strategies and implementing change throughout an organization. It would be very smart to implement these strategies in higher education organizations in order to remain competitive in today's society.

The organizational learning is to be the sum of individual and collective learning in the organization. Thus, a learning organization must constantly strive to develop and implement policies and strategies which encourage and make use of learning at all levels within the organization (Bui & Baruch, 2012). Like any other sector the higher education organizations is under increasing pressure. Bui and Baruch (2012) found that a higher education organization becoming a learning organization reveals that team learning is positively associated with teaching performance which is in-line with research in higher education. These findings seem to be in-line with the current requirements for high-quality teaching in higher education. Bui and Baruch (2010) manifest that the higher education organization to become a learning organization is a perspective that would be instrumental for higher education institutions to achieve competitive advantage to embrace innovations in internal organization, and ultimately improve student outcomes (OECD, 2015).

The evidence that there is a strong need for transforming education based organizations into learning organizations follows also from the OECD report (Kools & Stoll, 2016), in which suggestions are given how countries could transform its schools into learning organizations. It provides countries with insights into the progress made so far in establishing a professional learning and self-improving culture across the school system. Main outcomes of this report is an assessment of the change and innovation capacity in a school system conducted using an innovative form of the OECD Education Policy Review methodology consisting of: implementation of the schools as learning organizations assessment; the assessment consists of a questionnaire for teachers and school leaders, and a background questionnaire; analysis of the assessment to identify schools as learning organizations i.e. ‘good practices’ that could be developed into case studies.

Transformation of any organization, education, business or corporate based into a learning organization is the subject of long-term research and can be successfully realized with the help of different approaches (Argyris & Schon, 1996; Senge, 1990). The

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