Modeling the Dynamics of Knowledge Management in Educational Institutes: A System Dynamics Approach

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Abstract
Research problem. Recently, being known as the most vital asset to as well as the capital of organizations, the issue of organizational knowledge creation has attracted a great deal of attention in several settings encompassing educational centers and institutions. Not only may a high-quality capital account for the success of a given organization, publishing its success stories, and consequently both clients' and employees' satisfaction, it can result in the escalation of scientific, human, and financial resources. Knowledge management has been defined as the process of discovering, acquiring, developing, maintaining, evaluating, and applying the right knowledge at the right time by the right person in an organization through the creation of a link between human resources, information technology, and communication while creating a suitable structure for achieving organizational goals (Afrazeh, 2005). Similarly, Hoffman, Hoelscher, and Sheriff (2005) described it as the process of creating and sharing knowledge in such a way that the results can be used effectively in the organization. In educational institutions also, knowledge management is a systematic and organized process of creating and disseminating information, selecting, refining, and disseminating explicit as well as implicit knowledge, in order to create a unique value which can be used to strengthen the learning and teaching environment (Gonzalez & Martins, 2017). Having probed into the relevant literature, we realize that in many studies (Jashpara, 2004; Messa & Testa, 2004; Newman & Conrad, 2000) knowledge management includes four general processes: knowledge creation, knowledge retention, knowledge sharing, and knowledge application. **Purpose of the study**: In this research, using the system dynamics method, a model is proposed to identify the effective factors in the knowledge management cycle in an educational center. Then, the effectiveness of the identified factors over time is simulated and the changes in the behavior of the institute, which are the result of the changes in the behavior of the staff as well as capabilities and tendencies, are observable. This study attempts to identify the most influential factors in the knowledge management process using the presented dynamic model and by examining the factors. The levers suggest appropriate operations to focus on these factors. **Research method**: This is applied research that is conducted using the system dynamics approach introduced by Sterman (2000). This approach is used to represent the status quo of a system and its changes in the future. Identifying and problematizing the main issue through studying related works and interviewing twenty-eight experts in the field using a semi-structured researcher-made survey; creating dynamic hypotheses and drawing the cause-effect diagrams and the flow diagram; using Vensim software to simulate the mod, and finally, sensitivity analysis was the stages followed respectively. The results of this study showed that by implementing the knowledge management process in the institute, the performance of the teaching personnel increased in an s-shaped manner; the experience improved exponentially, and the family-student contentment improved which would consequently result in organization growth. Finally, the researchers presented and analyzed two proposed policies.
Keywords: system dynamics, knowledge management, simulation, , knowledge building, teacher performance, performance.

Моделирование динамики системы контроля знаний в образовательных учреждениях: системно-динамический подход

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Аннотация

Исследуемая проблема. Проблема формирования организационных знаний сотрудниками в образовательных центрах и учреждениях чрезвычайно актуальна в современном мире, поскольку именно организационные знания представляют собой наиболее важный ресурс и основной капитал организации. Значимость капитала отчетливо видна в том случае, когда он приводит к успеху, обнародованию новостей об успехе и, как следствие, к удовлетворенности сотрудников, студентов и, в конечном итоге, к увеличению научного, человеческого и финансового ресурсов. Как утверждает Afrazeh (2005), организация знаний – это процесс обнаружения, приобретения, развития и создания, обмена, поддержки, оценки и применения в надлежащее время нужных знаний нужным индивидом в организации на основе создания связи между человеческими ресурсами, информационными технологиями и коммуникациями. Это приводит к формированию структуры, подходящей для достижения целей организации. Как полагают Hoffman и др. (2005), управление знаниями – это процесс создания и передачи знаний в организации с целью их эффективного использования. В образовательных учреждениях управление знаниями также представляет собой систематический и организованный процесс создания и распространения информации, отбора, уточнения и распространения эксплицитных и имплицитных знаний, с целью создания уникальных ценностей, которые могут быть использованы для совершенствования условий обучения и преподавания (Gonzalez & Martins, 2017). На основании изученной литературы можно заключить, что во многих исследованиях (например, Jashpara, 2004; Messa & Testa, 2004, Newman & Conrad, 1999) управление знаниями состоит из четырех основных процессов: создание знаний, сохранение знаний, обмен знаниями и применение знаний. **Цель исследования:** В рамках данного исследования на основе методики системной динамики была предложена модель выявления результативных показателей процесса управления знаниями в образовательном учреждении. Далее осуществлялось моделирование эффективности выявленных факторов в динамике и наблюдение за изменениями в функционировании учреждения, обусловленные изменениями в поведении сотрудников, а также изменения возможностей и тенденций. В данном исследовании предпринята попытка определить наиболее значимые факторы, оказывающие влияние на процесс управления знаниями, на основе представленной динамической модели, а также на основе факторов и механизмов воздействия предложить надлежащие меры для воздействия на данные факторы. **Методы исследования:** Настоящее исследование является прикладным и основано на использовании системно-динамического подхода, разработанного Sterman (2000). Такой подход предназначен для моделирования текущего состояния системы и ее будущих изменений. Данный подход базируется на следующих этапах: определение и проблематизация проблемы на основе изучения соответствующих работ и опроса двадцати восьми экспертов этой области методом полуструктурированного опроса; выдвижение гипотез и построение диаграмм причинно-следственных связей и графиков; создание модели с помощью программы Vensim; анализ чувствительности. Результаты исследования показали, что внедрение процесса управления знаниями в образовательном учреждении привело

к s-образному росту его эффективности, а именно эффективности работы преподавательского состава, к экспоненциальному повышению квалификации и росту удовлетворенности учащихся и их семей, что, в свою очередь, привело к развитию организации. В ходе исследования также были представлены и проанализированы две предложенные стратегии.
Ключевые слова: динамика системы, контроль знаний, симуляция, модель, формирование базы знаний, эффективность работы учителей, эффективность работы

Introduction

The present study refers to the need for knowledge management in educational centers to promote organizational learning and improve performance in today's unstable environment. Organizations used to face rather stable environments, and the future events were almost predictable so that managers could plan in safe conditions. Today, rapid and tangible changes in various fields of science and technology have increasingly affected the existing processes in human societies. In such an environment, organizations, especially organizations and educational centers, need to redouble their efforts to survive. Traditional institutions and organizations are no longer able to adapt to these rapid and drastic changes and improve their performance, and only an organization has a chance to survive that can constantly adapt to changes in the environment around it (Liao & Wu, 2009).

The work process of teachers and instructors is very visible, so there is a need to be innovative both in the classroom they run and in the educational institution as a whole. It can be the best way to succeed and grow in the long run, as well as to face threats and take advantage of opportunities and innovate in education in various ways. Realizing these conditions, organizations decide to gradually move out of non-dynamic forms and traditional environments and towards the learning organization in order to maintain themselves in a turbulent environment where groups and individuals are constantly engaged in new learning processes. In short, the importance of organizational learning refers to its role as the key to the success of organizations in achieving longevity. It is due to the fact that the most successful organizations may survive if they suffer from poor learning, but they can never use their full potential (Senge, 1990). It can be seen that in a training center and even a wider environment - in any educational system - the quality of education depends on the teachers' quality of performance in that system (Khorshidi, 2003). Therefore, paying attention to teacher training programs in line with global developments and promoting knowledge to them (and further by them) is one of the most important issues in today's dynamic world. These global developments have created new requirements for teachers; needs that require the preparation and enhancement of education for both teachers and students. Teachers must adapt their knowledge, professional ability, and professional skills to future developments. The two components of knowledge and intellectual capital are the basis of competencies as well as a strategy to improve performance. In order to achieve a sustainable competitive advantage, it is important to pay attention to existing knowledge and use it effectively (Crasborn, Hennissen, Brouwer, Korthagen, & Bergen, 2008). Knowledge, as defined by Baker and Sinkula (2013) is the categorized and relevant information that is used in the organization and is applied in decision making. The difference between knowledge and data or information is in its applicability and practicality. Knowledge, compared to data and information, has a significant impact on cost reduction and process design since it has been applied to many different aspects and is no longer raw.

Drucker (1957, cited in Turriago-Hoyos, Thoene, & Arjoon, 2016) was the first one who tried to propose a new type of organization in which, instead of manpower, the power of the mind rules, and in the meantime, introduced words such as knowledge work, Knowledge worker, and knowledge organization to the world. Graff (2003) also

focused on knowledge organizations and divided organizational knowledge into two parts; intangible (tacit) knowledge such as personal beliefs, views and the expressive (explicit) knowledge which can be easily expressed, coded, stored, documented, and accessed in the process of analyzing and processing knowledge. Considering the role of each of these types of knowledge, some have taken this perspective in analyzing the methods of applying knowledge management in an organization and have classified them into dynamic, human-centered, system-oriented, and passive (Afrazeh, 2005). In this classification, the level of explicit knowledge depends on the degree of marking and storage of information required by an individual, and at the same time, the level of tacit knowledge is related to the level of knowledge sharing through the relationships between individuals (Afrazeh, 2005). Hoffman et al. (2005) believe that knowledge management is the process of creating and sharing knowledge in such a way that it can be used effectively in the organization. Bhat (2001) considers knowledge management as a process of facilitating knowledge-related matters (including creation, recording, transfer, and utilization) and believes that knowledge management involves a wide range of activities, learnings, collaborations, testing, and unification of different working and executive sets. Jashpara (2004) also defined it as an efficient learning process that creates, organizes, and exchanges knowledge and its application increases the organization's intellectual capital and improves its performance, whether this knowledge is explicit or implicit gained from the technology and cultural environment of the organization. Perez (1999) also states that knowledge management includes the provision of knowledge, wisdom, and value-added experiences of individuals within the organization so that it facilitates the retrieval and use of knowledge and protects it as an asset of the organization (Perez, 1999). According to McDonald (2002), knowledge management is the process of creative, effective, and efficient use of all available knowledge and information in the organization for the benefit of the customer and therefore for the benefit of the organization itself and this is exactly what teachers do, especially in elementary school; meaning that they always try to apply everything they have learned to best accompany and teach the students in their class – with different abilities and needs – in this way.

The knowledge management approach has been at the forefront of management content since 1990, and in fact, knowledge management has been passed on for hundreds of years, when family business owners and skilled professionals passed on their professional experiences to their children and students. Barron (2000) considers knowledge management as a systematic and integrated approach to recognizing, using, and sharing existing experiences and expertise in the organization. Parlby and Taylor (2000) looked at knowledge management as a movement that will conquer the future. According to Asgari (2006), the successful implementation of knowledge management requires the harmonization of various organizational factors, including organizational structure, organizational culture, technology, and human resources; so that people can manage their organizational knowledge to achieve the goals of the organization. On the other hand, it should not be forgotten that the kind and quality of knowledge in organizations are different from each other, and as Hassanzadeh, Fatemi, and Omrani (2008) state, in educational and learning organizations, due to the emphasis on immaterial issues, late returns, and results and diminishing economic role of knowledge, knowledge is mainly used as an intellectual capital to promote individual and organizational performance.

Therefore, it can be said that identifying the types of knowledge resources, their structure and amount, characteristics, the relationship of those resources and components of knowledge with one another, and also their type of operation, occurs only in the shadow of a deep understanding of structural reality and knowledge space of an educational organization.

The main purpose of knowledge management in schools is to help improve the performance of teachers and thus improve the performance of schools. Although knowledge management systems have been successful in industrial organizations, the models used by industries cannot be transferred directly to training centers and schools, but it is necessary to use these models to study educational organizations. The issue encouraged the researchers of this study to examine how and to what extent the impact of knowledge management on the performance of teaching staff is; since educational organizations are among the organizations in which it is necessary for a group of people with different job skills to anticipate, prepare, create, and provide different types of services for the educational setting and its main beneficiaries to-gradually- achieve their goals. As mentioned, knowledge management is the most important tool through which educators, especially teachers, can pave the way for, and guide schools, and students towards predetermined goals. This article consists of five general sections: introduction; research background in the field of knowledge management, system dynamics, and the use of system dynamics in knowledge management; research methodology dedicated to presenting dynamic hypotheses and causal diagrams; flow chart simulation, and finally interpretation of research findings and suggestions.

Literature review

The background of this research is reviewed in three different sections. First, it briefly examines the field of knowledge management and introduces the building blocks of knowledge management, then briefly examines the system dynamics approach, and finally, conducts research in this field.

Knowledge management is not an emerging concept; in fact, knowledge management has been the result of observing the progress of ancient civilizations. When old organized businesses were looking for a competitive advantage to serve customers more efficiently, maximize profits, and ultimately stay competitive (Crasborn, et al., 2008). But the formation of this concept first began with the 1994 annual report of a Swedish financial services company called Scandinavia. The company's report mentioned the value of the intellectual capital in the organization and the need to quantize it. In the new millennium, scholars and scientists have defined knowledge as an important organizational resource that has several theories. By collecting different models and theories, new areas of knowledge management were introduced. Due to the recent developments in this field, knowledge organizations have widely introduced the concept of knowledge management into the management and organizational literature. In the meantime, the development and improvement of human resource performance through education has been of high importance and educational centers and schools having a large population of students and teachers are considered the most important place for cultivating the IQ and knowledge of the society and the role of teachers and school principals in this issue is considered important.

The need for management knowledge in training centers to promote organizational learning and performance in today's unstable environment is due to the fact that organizations used to be in a stable environment and future events were almost predictable. Normally, managers could plan in safe conditions. It is not possible these days. Carroll et al. (2003) believe that knowledge management in schools is a challenge that needs to be addressed, because the culture in schools, although not unique, is very individual. He and his colleagues have listed seven issues as solvable issues through his school management: 1. Features of school exercises, 2. Acquisition and acquisition of knowledge, 3. Understanding information, 4. Information reconstruction, 5. Knowledge management support, 6. Valuation and 7. Knowledge management tools. There are

also six important issues for implementing knowledge management in schools, which are: technology awareness, developing attitudes toward innovation, using educational experiments with the help of modern technologies, applying appropriate technology to determine the boundaries of how to learn, analyzing knowledge for creating human and social capital and using knowledge management to maximize effective learning (Reynolds, 2005). The key to implementing these principles lies in creating an effective school and school-based management. In fact, the conscious and purposeful movement of teachers and school staff toward school-oriented education and effective school will pave the way for the creation, strengthening, transfer, and development of organizational knowledge in schools.

Here the role of the effective teacher becomes very prominent. An effective teacher can interest, challenge, and challenge the disciple. Effective schools and effective classes are those in which feedback methods are seriously established (Harris, 2004). In these schools, the development of the staff is given an important role and is considered a means to create innovation and continue the development of the curriculum. People participate in activities with every fiber of their being. Shared responsibility is the basis of creativity and collective initiative (Shoji, Graham, & Walden, 1993).

To effectively implement knowledge management in the form of school-based management, teachers and staff must participate in professional development. Teachers' professional development activities are oriented towards creating the ability to change, creating a professional community, and creating a knowledge base. In this context, focusing on continuous improvement along with skills training and education in the areas of education and vocational development curriculum is an important priority. Teachers should participate in educational opportunities regularly.

Many researchers tried to provide models of knowledge management including, Dehghani Saryazdi, and Owlia (2014), Khadivar and Javaheri (2015), Mathew, Rodrigues, and Vittaleswar (2012), Yim, Kim, Kim and Kwahk (2000), and Delen, Zaim, Kuzey, and Zaim (2013). Most of the proposed models are case studies, limited to specific conditions, or considered specific indicators in evaluating knowledge management. Fewer studies are devoted to presenting the connections in knowledge management processes which are mainly conducted in industrial contexts. In this research, an attempt has been made to provide a comprehensive dynamic model for knowledge management in educational centers so that it can be used in the implementation of knowledge management at any level. Also, with the help of the proposed model of this study, the level of the organization's knowledge base and the effect of the elements on each other can be predicted to the extent and the effective factors in reducing and increasing its distance from the ideal knowledge level of the organization can be examined. In this research, one of the models of knowledge-based management process has been used and it has been used to design a dynamic model. Different models of knowledge management have been proposed, most of which are more or less similar in content, but have different arrangements. Among these, the model of Probest et al. With the name "Foundations of Knowledge Management Building" (Probst, Raub, & Romhardt, 2000) is the basis for designing the dynamic model of this research. This model is relatively comprehensive and is compatible with the conditions of educational spaces. Considering a coherent framework for knowledge management is used as a guide for purposeful interventions to structure knowledge resources (Afrazeh Bartsch, & Hinterhuber, 2003).

Malhotra (2000) defines knowledge management as the process by which organizations acquire skills in learning (knowledge internalization, knowledge coding, knowledge externalization) and knowledge distribution and transfer. Probst et al. (2000) define it as the possession of individual and group knowledge that the organization can

use in the performance of its tasks; it includes knowledge, data, and information on which an individual or an organization is founded (Afrazeh, Bartsch, & Hinterhuber, 2003). In this study, the authors based their work on Probst et al.'s (2000) definition of knowledge management since they define knowledge management as a set of processes of identifying, acquiring, developing, sharing, using, maintaining, and evaluating knowledge. As mentioned earlier, in this study, the basic model of knowledge management building blocks is used as the basis for drawing a dynamic model. The designers of this model also see knowledge management as a dynamic cycle that is in constant rotation. The stages of this model include eight components, consisting of two internal and external cycles that are completed by feedback.

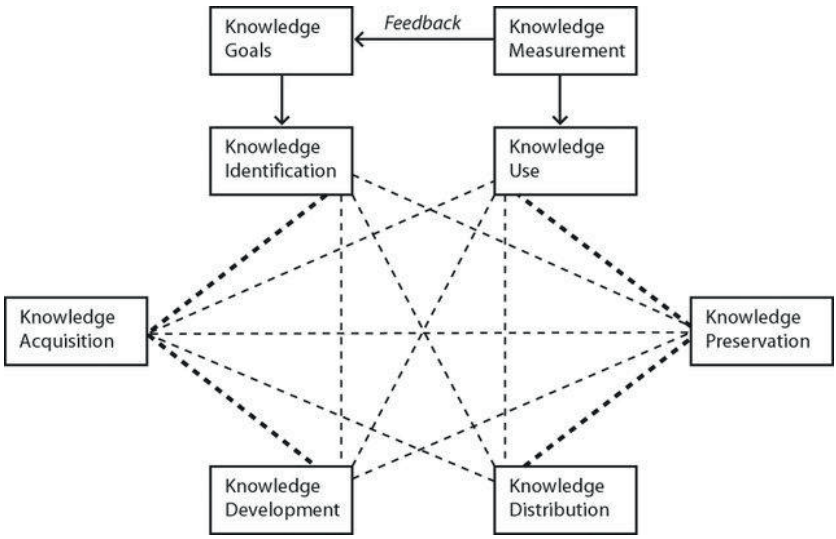

Figure 1. The Eight Building Blocks of Knowledge Management (Probst et al., 1997 cited in Burkhard, 2005, p.29)

As shown in the figure above, the main processes of knowledge management are:

- Identification: means identifying and recognizing internal and external sources of knowledge,
- Acquisition: Knowledge must be acquired from the domestic and foreign markets specified in the identification stage,
- Development: In the knowledge development stage, the knowledge of the organization should be expanded according to the existing foundations,
- Distribution: Knowledge distribution shows how knowledge can be transferred to the right place. The prerequisite for turning information into what the entire organization can use is the distribution and sharing of knowledge within the organization,
- Use: In the process of applying knowledge, the steps taken must ensure that valuable skills and large assets such as knowledge, records, patents, and licenses, are fully utilized,
- Preservation: Knowledge preservation means that previously acquired capabilities are not available automatically and at all times. Keeping information, documents and records requires management,
- Measurement: Knowledge measurement answers the question of how to measure the success of learning processes,

- Goals: Knowledge goals guide knowledge management; they determine what skills should be developed and to what extent this development should be.

Amrit (2002) categorized these items as knowledge management processes into three groups: acquiring ("Knowledge acquisition is not to be confused with information acquisition, Knowledge acquisition is the process of development and creation of insights, skills, and relationships" (p. 63)), sharing ("comprises disseminating and making available what is already known" (p. 65)), and utilization ("when learning is integrated into the organization" (p. 66).

The factors introduced in this model are consistent with the factors in the knowledge management process mentioned by Raudeliuniene, Tvaronaviˇ, and Blažyte (2017, 2019, and 2020). They claimed that Knowledge management practice in their study was a process-oriented perspective through knowledge management processes and the methods and tools employed in such processes. Some scholars (Costa and Monteiro, 2016; García-Fernández, 2015; Kianto, Vanhala, & Heilmann, 2016; Koohang, Paliszkiewicz, & Goluchowski, 2017; Obeidat, Al-Suradi, Masa'deh, & Tarhini, 2016; Probst, Raub, & Romhardt, 2000), have analyzed various combinations of knowledge management processes in examining the knowledge management process approach. Other researchers (Abubakar, Elrehail, Alatailat & Elci, 2019; Alavi & Leidner, 2001; Alshamsi & Ajmal, 2018; Cheng, 2015; Hayes, 1979; Park, 2006) have focused on recognizing subcomponents and further factors both in general and in educational environments including schools and colleges classified them according to their nature and content as human groups (personal, professional and social competencies, value, knowledge application), organizational factors (culture, motivation system, knowledge products, services), technological factors (knowledge infrastructure, databases) and financial resources.

Considering the approach applied in this study, the dynamics approach of systems J. Forrester introduced the MIT in the early 1960s. Systems dynamics is a way of studying and managing complex systems. These systems may exist in various fields such as business, economics, and environmental issues. The challenge is that social and human behaviors and their complexity make it impossible to study components, relationships, and changes in the usual ways. System dynamics provides a simple and flexible framework for modeling system components' behaviors to make decisions on dynamic problems (Alefari, Almanei & Salonitis, 2020).

The tendency toward system dynamics has grown since 2000 and its unique ability to truly represent the world in systems has been always the focus of attention (Alefari, et al., 2020). During the modeling process, modelers are involved in a process whose ultimate goal is to provide a reality-based model. System simulation usually leads to a new understanding of the behavior and structure of the system and ultimately allows for more complete models. Systems dynamics involve the development of fact-finding models for dynamic simulations that explicitly depict the feedback that interacts with a system (Sterman, 2002). The steps of the systems dynamics method comprise identifying and defining the problem, model presentation, model simulation in software, model testing, sensitivity analysis for validation, and policymaking respectively.

Having probed into the related literature, one can find the study of Kopainsky, Alessi, and Davidsen (2011) in which the system dynamics method was employed to provide a model for knowledge-based decision making. In another study, Chen and Burstien (2006) developed a dynamic model for exploring the dynamics of knowledge management in higher education and introduced factors of people, policy, and technology as influencing variables. However, there is still a research gap that provides a comprehensive model of the relationship and impact of factors involved in knowledge management in educational

institutions. The purpose of this study is to investigate the implementation process and impact of knowledge management in educational centers and to identify the impact of the involved factors on the performance of the organization and specifically teaching personnel overtime. In this regard, by designing a dynamic model, the relationship between the desired variables in the present time will be examined and the future changes will be observed. Thus, in this study the researchers are seeking answers to these qualitative questions:

1. What changes will occur in the performance of the training center in the next 100 months?

2. How does the process of knowledge management progress?

3. Employing this process, how will student enrollment change over the next 100 months?

Methodology

In general, research is classified into three categories: applied, fundamental, and developmental studies based on the purpose of research (Best & Kahn, 2006). This mixed-methods research is of applied type and its findings might be employed in the implementation and optimization of knowledge management in educational institutions as well as similar organizations. System dynamics is a tool to facilitate the study of the status quo and future changes of a system as well as future decision-making. With the help of the model presented in this study, knowledge management is broken down into its components, and then with the help of these elements, the foundation and knowledge management processes are organized in educational centers. Then, it is possible to assess the situation, activities, and processes related to knowledge management over time and to plan for changes in the performance of teaching personnel – and specifically teachers. As mentioned earlier, the steps of the systems dynamics method are:

1. Identify, define, and problematize: Model-makers need to fully understand the real problem and not the side effects, and draw a clear purpose for modeling. To this aim, the researchers studied previous research and provided a researcher-made interview protocol, containing eight questions, to conduct a semi-structured interview. They asked thirty-five elites and experts in the field of education, teaching, and management to participate in one-hour interviews and twenty-eight elites accepted the invitation and scheduled the interview time. The participants, selected based on a purposeful sampling method in order to gain the most comprehensive answers, were from educational institutes and universities as well as the industry sector. Interviews were conducted from November 11 to December 14. Having recorded and transcribed the data, the researchers sent the transcriptions to the interviewees to confirm. Aiming at extracting the main themes, i.e. the most influential factors known as variables, they used MaxQDA through stages of open-coding, axial-coding, and selective-coding.

2. Creating dynamic hypotheses: At this stage, the model boundary is determined via determining the general variables affecting the problem under study, using the knowledge existing in the field, and also employing the opinions of people involved in the study area, cause-effect loops are formed and gradually completed, to create a simplified picture of the real world of the problem.

According to Sterman (2002), cause-effect diagrams are drawn to determine causal relationships within a system and are generally divided into two general types: Reinforcing loops (positive feedback that coincides with the initial change) and balancing loops moving against the initial change. Implementing this process requires extensive data and information. One of the problems in this regard is the existence of diverse and extensive data. Nevertheless – and to direct the process of charting – the field research

and interviews with involved and knowledgeable people are one of the most important and valid methods of data collection (Ford & Sterman, 2003). In this study, based on the basic model of knowledge management building block and using the opinions of experts in the field of knowledge management and system dynamics and interviews with school employees, the factors affecting knowledge management in educational centers were identified and then the effect of these factors on one another was examined and determined in a causal-effect diagram. In the next step, the flow diagram obtained from the causal diagram was drawn (Figure 2).

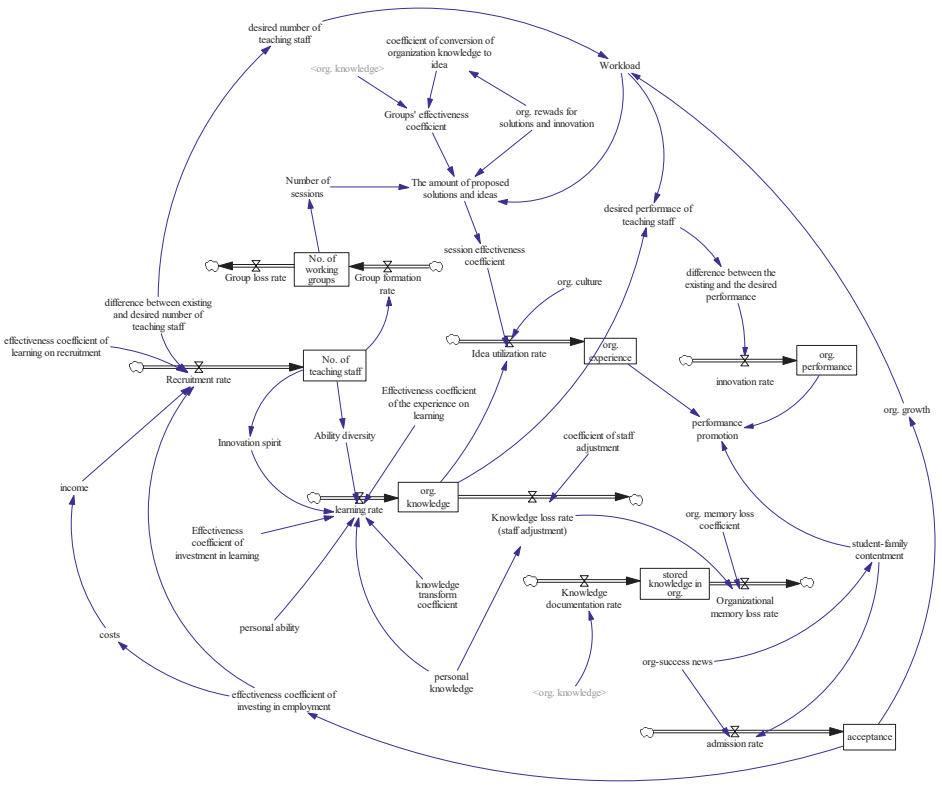

Figure 2. Flow Diagram of Knowledge Management in Educational Institutes

In this model, the researchers have focused on those factors and relationships that were more important than others. To this aim, they used a Likert scale to quantify the importance and effect of the qualitative variables – based on experts' opinions – and to formulate the variables. To obtain the formulas, the opinions of experts in the field of education were gathered in SPSS, and the coefficients and constant values were obtained by studying the previous statistics. Using SPSS, the researchers estimated formulas for variables.

3. Simulation of the model: Once the dynamic and boundary system hypotheses are formed, the model is implemented using the software. This model is often so complex that the dynamic relationships between its variables are not easily understood. For this reason, the model must be simulated to gain the behavior of the system over time. There are various applications and tools for this purpose and in this research, Vensim PLE software was employed.

4. Testing and validating the Model: It is necessary to compare the simulated behavior of the model with the behavior of the real world. This comparison helps to prove the readiness and validity of the model for use in future policies and planning of educational institutions.

According to Sterman (2000), testing the model and measuring its validity increase the reliability of the model and improve its viability. Aiming at achieving the desired goals, in order to design an applicable model, we need to ensure the validity of the model. Sterman (2000) also emphasizes that how to achieve this confidence depends on the design of the model. It is worth bearing in mind that there are no standard indicators and/or criteria in this field to apply to judge the validity of the model. However, model designers have introduced methods to this aim depending mainly on the type of the model and modeler. To ensure the viability of the proposed model, the implementation of only one of these methods assures us of the accuracy of the model. The present study focuses on three types of validation tests (Sterman, 2000):

1. Comparison of model behavior with a reference behavior: In this method, by considering the information of the preceding years in the model, the behavior is compared with the real behavior of the model;

2. Comparison of real and simulated behavior: The results of the simulation will be discussed with the managers and members of the organization and it will be checked whether the results obtained correspond to the expected results in the real world or not;

3. Sensitivity analysis of the model: In most dynamic models, even in many real systems used for specific purposes, sometimes the whole system shows one or more specific sensitivity variables; So that by changing their behavior, the behavior of the whole system is affected. In this test, the researchers intended to investigate whether the outputs of the model alter along with the changes made in hypotheses in a reasonable and specific range, therefore, the value of some of the main variables of the model, encompassing either the very low or very high ones, is changed, the sensitivity of the model is equivalent to these changes. In dynamic modeling, stability in the behavior of models is of particular importance and modelers make attempts to reduce, to the maximum possible extent, the sensitivity level of the model to the desired variables.

4. Policy-making: Aiming at improving the future conditions of the training center, distinct strategies, structures, and rules – appropriate to the conditions of the center- were adopted. In this regard, several hybrid policies are usually made use of to achieve more effective results (Ford & Sterman, 2003).

Results

Based on the findings of the simulation, as represented in Figure 3, by implementing the eight steps of knowledge management in training centers, the organizational knowledge follows a goal-seeking curve meaning that the process of knowledge growth in the organization has a steep slope at the beginning and decreases over time. It seems that the growth process has progressed well until it reaches a certain criterion and has gradually stopped or forgotten the goal.

In Figure 4, one can see that the changes in optimal performance of teaching staff during the process of knowledge management implementation have an upward trend exponentially as expected.

Figure 5 shows that the level of "stored knowledge" in the organization is boosted over time and follows the goal-seeking curve.

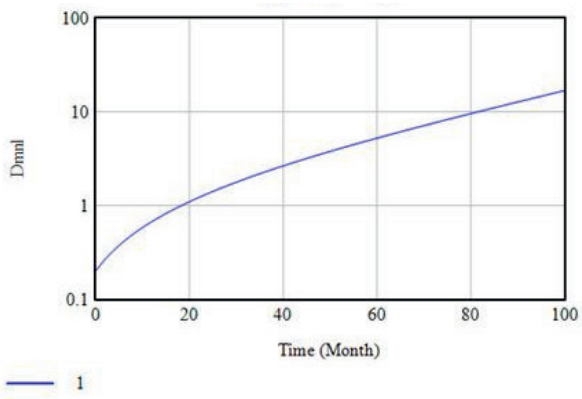

Figure 3. Changes in Organization Knowledge

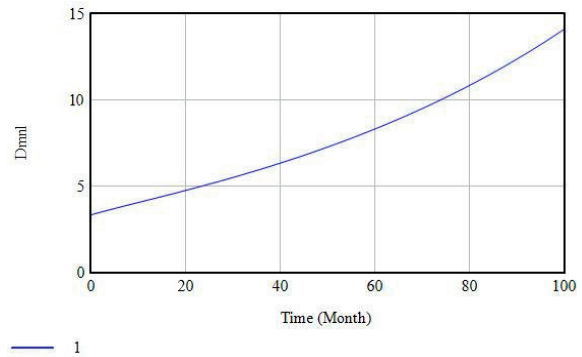

Figure 4. Changes in Optimal Performance of Teaching Staff

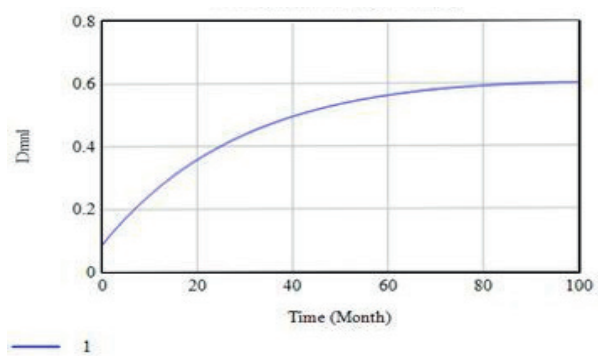

Figure 5. Changes in the Stored Knowledge

In Figure 6, it is clear that the amount of organization performance gradually increases, but the sharp decline in the slope (between 60 and 100 months) signifies the necessity of making appropriate decisions to maintain the performance growth in the organization.

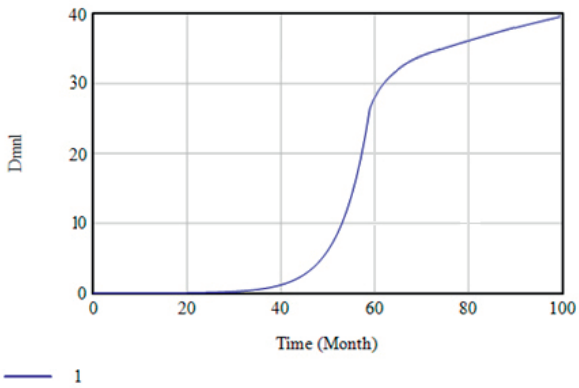

Figure 6. Changes in Organization Performance

As presented in other diagrams (including 7 and 8), as a result of applying this process, families' and students' level of satisfaction increases over time, and the experience of the organization increases exponentially.

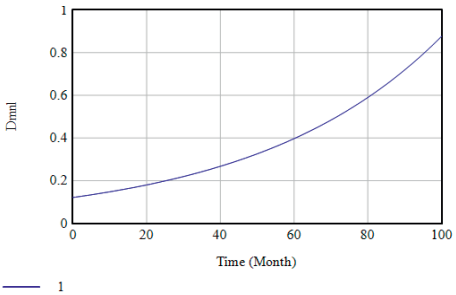

Figure 7. Student-family Contentment Over Time

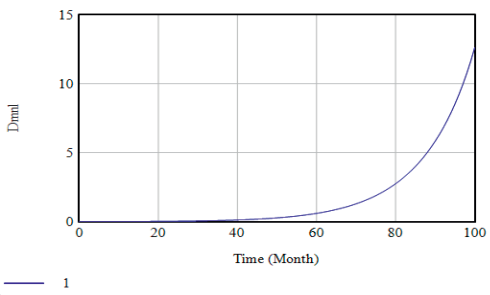

Figure 8. Changes in Organization Experience

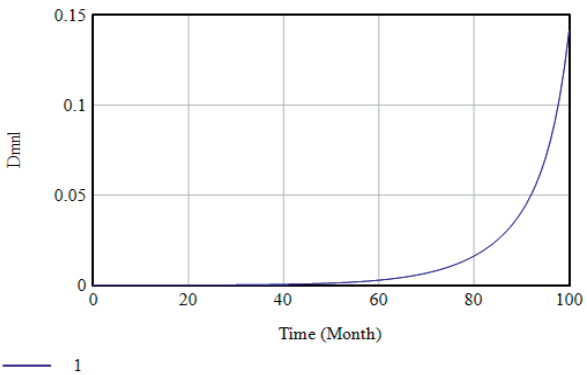

Figure 9. Changes in Proposing Solutions and Ideas Over Time

Figure 10 clearly shows the way the application of staff adjustment policies increases the trend of loss of organizational knowledge.

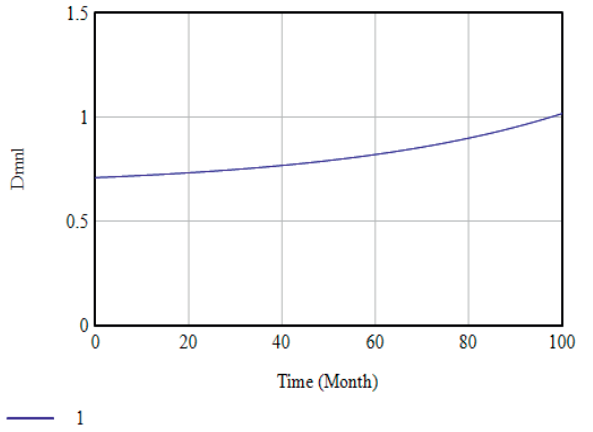

Figure 10. Changes in Knowledge Loss Rate (Staff Adjustment)

Figure 11 shows that, expectedly, the amount of workload accumulates over time, consistent with the results presented in Figure 6, and it can be said that the performance of the organization has affected the workload of training staff and has increased the workload.

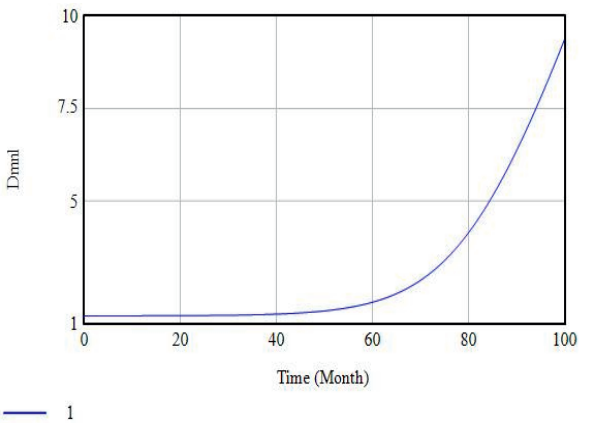

Figure 11. Workload Changes Over Time

Discussion and conclusion

Having changed dramatically in recent years, knowledge has been the focus of numerous scholars in the field of management science who have pioneered a new trend, management knowledge. Consciousness and ignorance as today's critical issues among nations and communities (Afrazeh, 2005) propose serious challenges to knowledgeable and capable human resources.

Manpower, as the most crucial, most exorbitant, and most invaluable asset to and resource for any organization, causes men, exclusively conscious elements and coordinators of other organizational factors, to play a pivotal role among all factors. Therefore, undoubtedly, hardly is it possible to achieve organizational goals without efficient people. In other words, human resources are considered to have a key part in the growth, dynamism, maturity, or failure of organizations.

On the other hand, teaching is a complex, dynamic, interactive, and multilayered activity (Ellis & Larsen-Freeman, 2009), and if teachers are to empower students "to think about their situation and explore possibilities for change" (Akbari, 2008, p.278), prepare them for living in a changing world, emancipating them from limited experience and introducing them to new ideas, they require a special managerial approach enabling them to train their students more effectively. Possessing an appropriate structure, culture, management style, power, and cohesion, an educational system is in charge of training people to run their society, ensuring the economic, social, and cultural health of that community, and accelerating its productivity and efficiency.

Along with researchers' constant effort to reform and improve the macro system of society, especially the educational system, to maintain the process of proper growth and excellence, this study was designed to provide a proper view of the notion of knowledge and knowledge management in educational institutes to observe the changes and manner of behavior of each component and finally to simulate the upcoming behavior.

To this aim, after recognizing the factors of the model, meetings were held with the officials and elites of the research unit. In the next stage, by completing the discussion and exchange of views, the accuracy of the results, their compliance with the behavior of previous years, and the compliance of the simulated future behaviors with their expectations were confirmed. The result indicated that the first two tests were confirmed. To further ensure the designed model, the sensitivity analysis test of the model was investigated. In this test, different policies were suggested and reviewed according to the objectives of the research.

These policies were mainly centered around knowledge management and teaching, and the effect of implementing different policies on some important variables of the model was also examined. In order to show the changes, the diagrams of the variables during the time of implementing knowledge management policies were represented. In this section, the proposed policies, in two sections of working reward and investment in learning are discussed.

A) The policy of change in reward: As presented in figure 12, the teaching staff's motivation for providing solutions and participating in the progress of affairs increases through the application of the policy of change (increase) in rewards. As the diagram indicates, a change in the amount of reward improves the effectiveness of activities as well as group participation of training personnel.

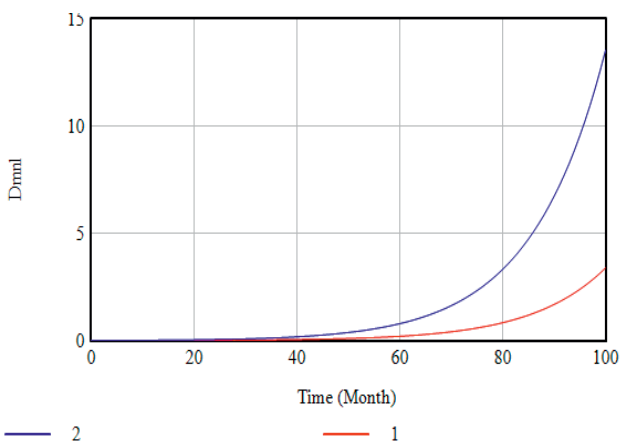

Figure 12. Effect of Reward Increase Policy

B) Change in investment in learning: Investing in the learning of teaching personnel (from 0.2 to 0.4) also leads to significant changes, and these changes directly affect teaching personnel's learning rate. Therefore, it may be recommended that educational center managers improve the learning rate in their organization by investing in the learning of educational employees, to the possible extent, by holding training courses, meetings, and workshops (Figure 13).

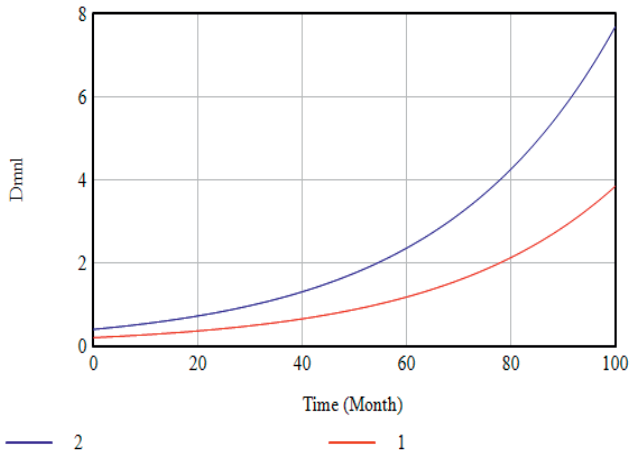

Figure 13. The Effect of Applying Investment Policy in Staff Training

As can be seen, the model is robust enough to change the parameters and no change is seen under the influence of the model (the behavior of the system), which in turn can account for the validity of the model, as well.

One may conclude that schools have been always involved in the notion of knowledge management. Teachers as good examples of knowledge managers provide dynamic environments for learners to learn independently. Moreover, a school, as an organization, is in charge of providing grounds for creating and nurturing, sharing and exchanging, promoting and organizing, maintaining and disseminating knowledge at the school level, and in the meantime interacting with other educational agents.

Playing a key role in training human resources of any society and having a pervasive influence on all human life stages, education accounts for the prosperity of nations. Accordingly, it can be inferred that having employed capable teachers, education has the responsibility for developing educational programs, while considering individuals' needs and interests, as well as transferring them to higher stages of knowledge management.

Under the unstable circumstances of the present era, a successful educational organization may be defined as one organization which gains extensive knowledge and awareness of both internal and external factors while simultaneously maintaining and improving the growth and dynamism of the organization. Such procedures occur through managing knowledge and information among teaching personnel at different levels of an organization and familiarizing them with probable problems and possible solutions over time.

In schools and educational institutes, paying attention to the notion of knowledge, which is of high importance, happens using developing teachers' various abilities, improvement of their participation in decision-making activities, considering of living conditions of teaching personnel, their needs as well as their workload, creation of an

environment of trust and collaboration in which individuals can learn from and share experiences.

To create such a vivid setting, the following might come in useful: An emphasis on the establishment of knowledge management in schools; consideration of teachers as the main influencers of human resources particularly adolescent and younger generation; purposeful investments in teachers' potential capabilities; provision of support to schools to advance their knowledge management through teacher education; use of effective strategies of knowledge management to create a sense of effectiveness in teaching personnel; and finally, implementation of knowledge by school principals through management of knowledge and experience exchange among employees.

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