A computational narrative construction method with applications in organizational learning of social service organizations


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A R T I C L E  I N F O

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A B S T R A C T

Acquisition of knowledge must be interwoven with the process of applying it. However, traditional training methods which provide abstract knowledge have shown ineffective for gaining experience of the work. In order to solve this problem, more and more researchers have included narrative in simulation, which is known as narrative simulation. By providing the narratives, participants recognize the choices, decisions, and experience that lead to the consequences of those decisions. It has been proven that narrative simulation is very useful in facilitating in-depth learning and reflective learning. However, conventional methods of data collection and narrative construction for narrative simulation are labor intensive and time consuming. They make use of previous narratives manually and directly. They are inadequate to cope with the fast moving world where knowledge is changing rapidly. In order to provide a way for facilitating the construction of narrative simulation, a novel computational narrative construction method is proposed. By incorporating technologies of knowledge-based system (KBS), computational linguistics, and artificial intelligence (AI), the proposed method provides an efficient and effective way for collecting narratives and automating the construction of narratives. The method converts the unstructured narratives into a structural representation for abstraction and facilitating computing processing. Moreover, it constructs the narratives that combine multiple narratives into a single narrative by applying a forecasting algorithm. The proposed method was successfully implemented in early intervention in mental health care of a social service company in Hong Kong since the case records in that process have structural similarities to narrative. The accuracies of data conversion and predictive function were measured based on recall and precision and encouraging results were obtained. High recall and precision are achieved in the data conversion function, and high recall for the predictive function when new concepts are excluded. The results show that it is possible for converting multiple narratives into a single narrative automatically. Based on the approach, it helps to stimulate knowledge workers to explore new problem solving methods so as to increase the quality of their solutions.

1. Introduction

Mental health problems impact seriously to the society. The impact of mental disorders can be reduced by identifying the distress at an early stage, establishing an early and accurate diagnosis and providing prompt and effective treatment. This idea underlies the interest in early intervention in mental disorders. Some countries have put this as a major element in their mental health policy (Kemp, 1993). Evidence from many evaluation studies suggests that well-designed and intensive early intervention programs have the potential to yield outcomes that benefit health plans (e.g., improved health outcomes, lower health care costs, lower maternity costs, fewer emergency room visits) and the outcomes that have potential benefits for Medicaid, the government, and society as a whole such as higher educational attainment, greater economic self-sufficiency, lower crime rate, etc. (Perloff, Butler, Berry, & Budetti, 1998).

However, there is a variety of challenges faced by the mental health social service providers (Ferns, 1995). The increased need for services, decreased subvention for services due to the economic restructuring and the attendant quest for budget cuts, and growing government regulation lead to the formulation of an immense pressure to social service organization to provide effective, customized and high-quality care at the lowest cost and greater administrative control (Savage, 1987). The social service providers are facing the problem of conflict between these objectives. Limited resources must be traded off in order to accomplish any one of the objectives over the others. Shrinking revenues have forced the social service providers to look for creative ways to provide quality services at less expense.
As a result, any techniques or methods that sustain knowledge
growth and distribution are keys to quality services (Von Krogh &
Grand, 1999). The most typical way of learning is providing training
for the workers. In the traditional model of on-the-job training, workers would typically receive a pre-prepared course in the new
regulations, procedures, or processes to promote the new practices.
They are often at a different location from their place of work and
they are expected to apply this abstracted knowledge later in their
workplace. As indicated by the figures of training effectiveness, the
results are often observed not to be encouraging. Businesses spend
up to USD$100 billion per year to train up workers. Yet estimates
are that less than 10% of this training transfers to the job (Det-
terman, 1993). Norman (2000, 2003) also presents a very interesting
discussion of full-curriculum interventions versus small-scale
laboratory studies and concludes that curriculum-wide studies are
not worth the effort involved in doing them.

Current theories of learning reveal that the knowledge acquisi-
tion process cannot be separated from the process of applying it.
The effective integration of working and learning is a fundamental
requirement for businesses to remain competitive. Brown and Du-
guid (1991) also argue that learning is the essential bridge between
working and innovation, and the three processes are inextricably
intertwined. They argue that on-the-job training separates simpli-
ified abstract principles from the rich detail of actual practice and
separates learners from the workplace community. Instead, they
advocate that technology and business processes should support
the existing rich learning practices within the workplace commu-
nity by enabling individuals within communities to somehow re-
tain and share their experience. This influential article has inspired many projects in knowledge management (KM) and orga-
nizational learning (OL). Hence, the approach of acquisition and
sharing existing experience is the key goal of many OL approaches
(Landes, Schneider, & Houdek, 1998).

Numerous learning systems have been developed for the reten-
tion of information and knowledge of organizational problems.
Some of them are dedicated software tools intended to offer a vir-
tual educational and/or online training environment. They provide
dynamic capabilities to acquire and share the knowledge within an
organization so that the knowledge workers can learn and cope
with their work effectively. Despite a large number of functions
covering a large number of users’ needs, the traditional methodol-
gies of learning systems are fundamentally limited. These tools
provide past information or cases for training and decision support,
which is insufficient to cope with the complex, diverse and contin-
uously evolving business environment. Such kind of systems may
hinder innovation by providing previous experience for problem
solving.

Recently, more and more researchers have incorporated narra-
tive into learning. Such kind of manual simulation practice is
defined narrative simulation. It is interesting to note that narrative
simulation is very useful in facilitating in-depth learning and
reflective learning (Cole, 1997). According to Argyris (1977), reflec-
tive learning is the core of organizational learning. Reflection can
be seen as “consciously thinking about and analyzing what one
has done (or is doing)”. Reflective Learning is a structural approach
that enables learners to reflect upon their learning, to understand
their own learning processes and thus allow them to become more
autonomous. However, traditional narrative simulation makes use
of previous narratives manually and directly which is inadequate
to cope with the fast moving world where knowledge within orga-
nizations is changing rapidly and continuously updating is vital.

Since the case records in early intervention in mental health
care have structural similarities to narrative, a computational nar-
rative construction approach is proposed in this paper for provid-
ing a reflective training of early intervention in mental health
care. The proposed approach aims at collecting the narratives
and constructing a scenario by combining the collected narratives
automatically. It integrates the technologies of knowledge-based
system (KBS), natural language processing (NLP), artificial intelli-
gence (AI) and computational forecasting method. Based on the
approach, it provides extra time for the knowledge workers for
exploring new problem solving methods so as to increase the qual-
ity of their solutions. A series of experiments based on real cases
have been carried out for measuring the accuracy of data conver-
sion and the accuracy of narrative prediction.

2. Related work

Narrative simulation is frequently employed in instruction
aimed at accident prevention, farm safety, and solving work place
problems. It starts from defining the topic of simulation. Based on
the selected topics, stories are collected through interviews, focus
group, participant observations, etc. It is arguable whether any
plausibility story or an actual story should be used. Some research
work suggests that it would be more powerful to use an actual
contemporary story to support reflection and change (Bliss & Ma-
zur, 1996; Phillips, 1994) while some other researchers suggest that
verisimilitude or plausibility is sufficient in narrative (Bruner, 1990;
Phillips, 1994). The stories collection process is not only time con-
suming, labor intensive but also heavily relied on the experience
of the story teller. In this paper, a novel computational method of
generation of narratives is proposed to overcome the challenge
and address the deficiency in story collection and construction.

Computer-based text generation has been an area of interest for
many researchers. Early systems included interactive story seg-
ments where the system would produce part of the story and then
wait for user interaction before producing more of the stories such as ZORK (Infocom, 1979). Some systems include initial conditions
or story grammars could be changed in order to produce brand
new stories such as TALE-SPIN (Meehan, 1977) and UNIVERSE
(Lebowitz, 1985). TALE-SPIN was a program that produced stories
by setting goals for characters and then recording their attempts
to reach the goal. It demonstrated how computer techniques in
problem solving can be applied to storytelling. They were success-
ful in showing the ability of computers to generate very short
coherent stories. However, they were only able to generate a lim-
ited range of stories within a rigid pre-defined structure of the sto-
ries. Some researchers have employed story grammars to produce
automatic storytellers such as GESTER (Pemberton, 1989) and JO-
SEPH (Lang, 1997). Story grammars were developed with the objec-
tive of creating a theory of story understanding. They represent
stories as linguistic objects which have a constituent structure that
can be represented by a grammar (e.g. Lakoff, 1972; Mandler &
Johnson, 1977; Rumelhart, 1975). However, such kind of systems
was only able to produce stories that satisfy its grammar and is not
able to modify its knowledge to generate different outcomes.
Current systems such as BRUTUS (Bringjord & Ferrucci, 2000)
are hybrid systems which consist of merging different known
methodologies into one program.

Most of the previous research works appear to consist of prede-
fined conditions, predefined goals, and inferred post-conditions.
The resulted narratives are hence rigid and lack of diversification.
The top-to-bottom approach requires large amount of workload
for constructing and maintaining the predefined elements. In this
paper, the authors attempt to develop a bottom-up and semi-auto-
matic approach for the collection of narratives which helps to save
the time and reduce the cost for maintaining the knowledge up-
date. Furthermore, the model makes use of a computational fore-
casting method, which automatically constructs the scenarios
based on multiple narrative resources, in order to prevent the sim-
ple and direct usage of previous narratives.
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