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Are there typological characteristics of individual unlearning?

Abstract

Organizations have sought solutions to produce consistent, competent practices while updating organizational processes. A traditional method of learning used strategies of identifying gaps in knowledge, and teaching lacking information to close gaps. Faulty learning completion processes often yield decreased work product quality, and productivity, or increased product costs. Knowledge base change creates ongoing difficulties for individuals who must unlearn, store, and use new knowledge processes to update the old. Knowledge change, or unlearning, speculated to involve a replacement of prior knowledge remains unconceptualized due to limited, anecdotally based research. This qualitative study aims to further characterize unlearning initiation processes, and clarify knowledge replacement factors: 1) How does individual unlearning initiate? and, 2) What factors contribute to the unlearning process? Three weekly-spaced interviews with 31 participants categorized unlearning using Rushmer and Davies' (2004) typological unlearning model. Predominately two knowledge change typologies were demonstrated and a new unlearning model developed.

1. Introduction

Change is a part of our global business environment. Organizational leaders deal with ever-expanding knowledge base and its implications. Marketplace shifts, regulatory, and technological process modifications all impact the success potential of a business.

As the amount of information within an organization increases, knowledge is increasingly more difficult to manage. There has been a rapid rise in the number of organizations that produce goods and services within the global marketplace that depend upon consistent knowledge management practices. Knowledge acquisition and management is now essential to maintaining a competitive advantage. Organizations with the ability to manage the precious resource of knowledge will be far ahead of those that only manage tangible items such as, goods, labor, or resources. The organizations and individuals that have the capacity to understand these knowledge management concepts have advantage over those that do not [1].

The acquisition, refinement, and change of basic employee competency considering the environmental, technological, regulatory, and financial

changes within the marketplace present an ongoing problem for organizations [2]; [3]; [4].

When organizations fail to maintain competitive advantage, change becomes necessary. The difficulty arises when leaders must create the rapid alteration of actions, behaviors, and 'mental models' within their employees [2]. Attempting to acquire and maintain current knowledge involves transmission of knowledge from the organization to the individual employee [3]; [4]; [5]. For the organizational individual, additional processing, retention, and modification of their knowledge base to correctly perform job-related procedures is necessary. Surviving organizational knowledge change with updated knowledge and personal competency is an ongoing problem [4].

Rapid shifts in current knowledge base is essential to performing organizational tasks, avoiding errors, and rework which can impact success of change undertaken [2]; [5]; [6]. Implementation of new knowledge management processes may also result in added time and energy to complete updated job procedures. Modifications of individual current competencies during organizational change and how these processes occur play a large role in organizational success or failure. Understanding knowledge change, or unlearning, long speculated to involve a replacement of prior knowledge, remains under-researched.

Previous research across many disciplines has been interested only in learning, and other methods of knowledge acquisition in individuals and organizations. It is how individuals within organizations produce needed changes in their previously held actions and procedures which is of interest. Although forgetting and extinction may have some impact on unlearning, they will not be included in this discussion as it is unlearning of routinized knowledge that is the focus. These concepts may perpetuate additional confusions where unlearning is concerned.

In times of shift in organizational processes, such as the introduction of a new product, or a technological advance, unlearning is needed to perform in new ways based on the previous competency level. Unfortunately, individuals within organizations may be unable, or unwilling to abandon current knowledge base, beliefs, processes, and values rapidly enough, or unlearn, when confronted with new and updated information [6]; [7].

Often organizations require a 'forceful trigger' to begin the process of unlearning after a failure or during crisis management [7, p. 96]. When individual unlearning is not successful, key changes

fail to occur. Based upon previous studies, this author suggests the most resilient organizations and individuals use a unique orchestration of processes that yield not only successful, but a complete change process whereby avoiding technological upset [3].

Understanding unlearning processes may forge the divide between knowledge acquisition and change processes for training individual workers to meet new demands during organizational change. It is here we examine the unlearning process of organizational individuals who are required to update routinized knowledge when faced with outdated knowledge or processes. This effort may help develop effective training methodologies that maximize worker competencies.

The objective of the current literature review will shed some light on the variety of disciplines impacting and contributing to current understanding of the unlearning process [6].

2. Theoretical Background

Early learning and theorists

Historically, many theories of learning have provided the foundation and theoretical basis for the complex process of unlearning. It has been postulated that the learning and unlearning process have potentially a similar process [8]. Numerous principals such as learning theory, methods of knowledge acquisition, extinction, forgetting, and change theory have added contribution and confusion to the process of unlearning. From the early learning theorists in classical conditioning, associating behavior to stimuli, to the consequences of reinforced behavior, theorists establish the process of learning a skill was of interest. Even the “laws of learning” gave rise to our understanding of individual knowledge acquisition [9]; [10]; [11].

In Bloom’s taxonomy, three classifications of learning were represented; the cognitive, affective, and the psychomotor/sensory domains [12]. Each has a specificity that characterizes individual knowledge acquisition and may have impact on the unlearning process. The cognitive domain describes learning processes as, Remember, Understand, Apply, Analyze, Evaluate, Create knowledge in situations of acquiring the new [12]. The affective domain examines the emotional reaction to new knowledge. The cognitive domain uses processes of higher-order reasoning and self-control. The psychomotor domain involves using sensory information to produce motoric activity, as in operating a computer [12].

In the first two domains, there is emotion, self-regulation, and willful control that create difficulties in properly examining the knowledge change process. Studies completed may include some blurring of the process, and as a result unlearning may not be observed

in its pure form. It is only in the psychomotor domain that study of unlearning and the initiation of the process should begin.

Argyris and Schon’s work in “single” and “double” loop learning also help to explain adult learning processes [13]. Single loop learning involves changing actions to close the gap in skills and involves a focus on error detection and correction, whereas double loop learning views the process through adding a reflective questioning of the actual framework of knowledge and realization that knowledge held may be faulty and require correction [13]. This has yielded training frameworks to close gaps in knowledge. The impact of this research suggests that the questioning of errors when detected, may be central to the emerging theory of unlearning.

Mezirow differs by postulating three stages of learning: the “instrumental stage,” where awareness of new learning begins, followed by transmission of knowledge in the “transformation” and the “communicative” phases [14]. The first level of learning, the instrumental stage, have comparable activities equated with theories of Starbuck where testing old knowledge, reflection, and experimentation with new assumptions occur [8]; [15]. Knowledge transformation compares to Senge’s concept of reflection and discourse where the individual sorts out their previously held ‘mental models’ and reconciles them with newly acquired knowledge [14]; [2].

It is in these junctures that unlearning begins to diverge from learning theorists. In knowledge acquisition, or learning, the individual develops skills through adding content-based information [14]. Although seminal in diverse area including psychology, education, organizational leadership, and knowledge management, theorists have yet to pinpoint factors that explain and document the unlearning process.

The unlearning theorists

Currently, researchers have recently returned to unlearning due to its importance in both the organizational and individual learning change processes [3]; [4]; [15]. Table 1. outlines seminal theorists to provide background, historical perspective, and insights as to the lines of research and open problems.

Unlearning has been defined as the process of replacement or disuse of knowledge, action, or procedure whereby substituting new knowledge when appropriate [16]; [8]; [3]. Change processes involving modification or replacement of current learning may indicate unlearning is occurring [16]. Through unlearning, previously routinized learned knowledge or procedures are modified by successfully altering skills with new emerging knowledge, thus completing the learning process [4].

When realization about the need to update skills or behavior is initiated, the unlearning process begins [8]. A behavior or knowledge is then stabilized and successful completion of knowledge change has occurred. The conditions required to understand this complicated cycle need to include and are the result of the process of unlearning [8]; [17]. Knowledge change that focuses on non-self-regulation or behavior that is unable to be controlled require psychomotor skills. This allows the unconscious completion of a task and in this author's opinion, represents a purer form of unlearning.

For example, in the process of habit formation, defined as automatic, unconscious actions developed through repeated patterns of behavior may be a parallel to or include parts of the unlearning process [18]. It is repetition of behavior in context that creates a new skill and the structure of mental model frameworks. When new skills are stabilized and used consistently, habit is formed. Habit, or stabilized knowledge becomes the current knowledge base for behavior and mental models [3]. When unlearning change is initiated, habit is weakened, and knowledge has the potential for change [3]; [18]; [19].

When the old, automated habits make way for new actions and behaviors, the unconscious, automatic knowledge becomes destabilized creating the basis for change [20]. The individual develops a state of unconsciousness unawareness of the procedure or action involving the need for changed knowledge [19]. The unconscious or habitual parts of the unlearning process remains yet unidentified [4], [3], [17]. There has not been enough empirical study on this type of individual knowledge change.

Unfortunately, this also may be the point of confusion between learning models and knowledge change, or the unlearning process exists. Studies have not yet examined routinized, automatic behaviors enough which are central to knowledge change in the unlearning process [5]. For example, according to [21], "At present, there is little information on individual change in organizations because approaches to managing change have been developed at the group or system level" (p. 22).

Theorists also have not accounted for issues of knowledge storage, retrieval, and successful knowledge updating processes. In addition, Klein posits that problem of knowledge storage needs a solution where unlearning may play a role [22]. Clark has discounted this concept as faulty, suggesting individual knowledge in the brain could not be expansive enough to store and process vast amounts of data without a specific capacity [19]. If a total removal of old knowledge, or a "clean slate" would occur, this would suggest the brain erases unneeded information and could be compared to "forgetting" often occurring within organizations [23]; [19].

Authors Griswold and Kaiser, theoretically suggest that reducing old influencers are triggered by disequilibrium in previously held routines [24]. These behaviors are discarded intentionally to become a better version of self; however, this implies unlearning is entirely under cognitive control [24]. Knowledge change has continued to create confusion because self-regulatory and higher-level cognitive functions often associated with unlearning. Here, unlearning is seen more of a cognitively-based process whereby old knowledge can be chosen to be changed or used [24].

Clark best summarized unlearning through three distinct features by stating:

- 1) Adults are largely unaware of how they acquire and change knowledge and the strategies they are using;
- 2) When change strategies fail, one of largely unexamined causes is the interference caused by automated and cognitive behaviors we wish to change; and,
- 3) we know very little about how to unlearn dysfunctional automated and unconscious knowledge [19].

This suggest unconscious, knowledge routines within psychomotor control which researchers have yet to discover. The seminal theorists are listed in Table 1.

Unlearning may represent different typologies as suggested by Rushmer and Davies (2004). Consider clerks that complete standardized forms. When a new form is introduced, there is a change process to correctly complete the new form. Over time, a new routine replaces the old. Could it be that disuse or some form of forgetting is present? Or, could this be unlearning? [5]. In this example, unlearning involves past learning that is no longer needed. There may be different types of unlearning depending on the situation, knowledge, skill or procedure type involved in the change process.

In Rushmer and Davies (2004) typologies, unlearning was explained to demonstrate a differentiation between knowledge change situations. The first typology, 'routine unlearning' may suggest that there is a passive replacement of behavior due to changes in a process or routine [6]. In this typology, no effort is used to change and usually occurs through disuse and attrition of information.

Knowledge change, the second typology, involving unlearning new procedures and behaviors, called '*wiping*', occurs with deliberate speed and may include experimentation along with insight. The individual possesses an ability to stop behaving, or is influenced to make a knowledge change [6]. Wiping occurs when the impact of new knowledge is strong enough that the individual recognizes that errors in their current knowledge base requires updating. For example, when a new drug regimen becomes a standard of use in healthcare; or in computer systems, when the change in a system where operation using an old process would be inefficient are two examples of a wiping typology [6]. Both represent an ability to make a change within a process of behavior when needed.

Stories of companies such as 3M, Toyota, and Sony can be cited as examples of organizations using

account suggested in advance that there would be an attack on Pearl Harbor where evidence was largely ignored, thus unlearning did not occur, and the

Table 1: Unlearning theorists

Theorist	Type	Unlearning Definition
Cegarra- Navarro & Dewhurst (2006)	Organizational	The removal of old knowledge while blocking new knowledge.
Duffy (2003)	Individual	Unlearning is a 'letting go' of old behaviors to replace them with new behaviors.
Hamel & Prahalad (1994)	Organizations	Elimination of old logics by organizations New logics when environment changes.
Hedberg (1981)	Both	Individual learning is central to organizational learning as the individual contributes to what constitutes organizational learning. Unlearning helps organizations gain new knowledge.
Huber (1991)	Organizational	Compare Lewin's three-step model (1989, 1951) with the organizational unlearning. Authors suggest unlearning is a process occurring in organizations or individuals.
Kim (1993)	Individual	Focus on the relationship between individual mental models and organizational memory. Organizations learn due to their individual members.
Klein (1989)	Individual	Old knowledge is stored for situations where newly acquired knowledge is not appropriate and is a replacement strategy.
Mezirow (1991)	Individual	Frames of reference impact our attention and concentration for learning and possibly unlearning.
Newstrom (1983)	Individual	The idea of the "clean slate" as an acquisition of new knowledge; there is an infinite ability to add knowledge without alteration of previous learning.
Nonaka & Takeuchi (1995)	Both	Types of Knowledge: Explicit and Tacit Both types are involved organizational and individual learning and unlearning processes. Knowledge creation and knowledge conversion theories
Nystrom & Starbuck (1984)	Individual	Removal of barriers to learning through a process of changing pre-existing knowledge
Cegarra- Navarro & Moya (2005)	Both	Two types of unlearning include group and individual.
Polanyi (1966)	Both	Development of types of knowledge has an impact on learning and unlearning.
Starbuck (1996)	Individual	The unlearning process uses anecdotal stories When unlearning, a person can no longer rely on knowledge, or belief. People experiment testing current assumptions to change.
Wheatley (2006)	Individual	When knowledge is acquired, it becomes part of awareness, and change, but may not be used.
Zell (2003)	Individual	Experts are less likely to be good at unlearning due to their firm beliefs in current knowledge.

(Adapted from Hafner, J. (2014) Unlearning in Organizational Employees-. Dissertation), [25]

an organizational practice of wiping where change in current knowledge becomes needed to maintain competitive advantage in the marketplace [15]. However, numerous accounts exist where information was ignored or discounted preventing wiping to occur and unlearning was unsuccessful. One historical

consequences were dire [15].

The third typology, or 'deep unlearning', is characterized as disruptive, often including a sudden event occurring with great speed whereby the initiation of unlearning is directed from an outside catalyst [6]. The experience is often described as painful and occurs

quickly limiting reflection. Previous routines are no longer the same and complete transformation has occurred [6]. An example could include the idea of a fire causing family members to leave their home without belongings.

Unlearning continues to be an important part of successful knowledge change. When complete unlearning occurs, all processes are functioning at their peak in job task routines without error. These typologies are worthy of study to determine whether unlearning can be characterized in a new framework

Unlearning terminology continues to be considered multidisciplinary, lack of a consistent definition remains without consensus. Unlearning is a knowledge change process with additional empirical identification of specific factors. ...” Climbing the learning curve is only half of the process... the other half is the unlearning curve” [6, (p. ii10)]. The following investigation will address typologies of knowledge in experts with a previous knowledge base to determine whether their experiences in unlearning can be categorized using the Rushmer and Davies’ typology model.

3. Statement of the Problem

When organizations require competitive advantage for success, continual updating becomes necessary. Instructions for a rapid alteration of actions, behaviors, and ‘mental models’ within their employees are often difficult to produce [2]. Poor knowledge management can result in unintended increased operating costs for the organization. Surviving continual organizational updating while maintaining competent employees is an ongoing problem [19]. However, required changes in the acquisition and management of knowledge need a new understanding of the unlearning process. The processes to change knowledge needs further investigation when individual knowledge resources are required to be updated [3]; [4]; [10]; [19].

With individuals responsible for completing new tasks, the strategy of how to change or unlearn previous processes and produce new competencies has been of interest. Previous studies have considered organizational unlearning through a variety of lenses but the understanding of individual unlearning has lagged [27]; [28]. An ongoing disagreement regarding a consistency in the concept of unlearning remains a persistent problem. The unique characteristics of this process remain somewhat ill-defined for individual employees and much work remains [3]; [4].

Unlearning remains an undiscovered process with worthy studies from many disciplines yet to define specifics of the process and environmental conditions of occurrence. Questions such as, How,

when, and why does knowledge change occur? ; Does change come from either an internal self-regulation process or an outside catalyst? ; What type of knowledge is involved? ; How stable is the knowledge base? These unique pieces of the unlearning puzzle require further investigation and study.

This paper adds an extension of the unlearning concept by: 1) investigating and collecting descriptive characteristics of unlearning in individuals using the typological from Rushmer and Davies [5]; and 2) and proposing additional refinements to present a new conceptual model of the unlearning process. The following research question and sub-question investigated:

RQ1. *How is individual unlearning initiated within change-based organizations?*

SQ 1. *Are Rushmer and Davies’ unlearning typologies are exhibited in the unlearning process?*

To answer RQ1, multiple semi-structured interviews allowed participants to discuss job role unlearning experiences. For SQ1, Participants’ thoughts and perceptions about unlearning typologies were identified, categorized, and subsequently analyzed for the presence of the three typologies.

4. Research Method

Overview

This study focused on unlearning involving a change in procedural operation of a computer application. A midsized engineering firm using computer systems provided participants for this study. The organization instituted a company-wide upgrade in their Windows environment creating the need for unlearning of routinized actions. The types of tasks involved were those that would make completion of job functions obsolete on the updated system.

The organization had made a recent change in computer systems and application for job tasks requiring the employees to use actions that were not available in the previous Windows system or applications. These updated systems within the company made the current knowledge base ineffective in the operation of the upgraded system. The specific change in computer systems involved outdated systems or applications, such as Windows 7, upgraded to Windows 8 and involved user interface that had significant revisions.

For this study, the instituted change was considered a revision to previously used automatic motor movements where current skills were deemed obsolete and unusable thus, required knowledge change and unlearning of the old system.

Specialized employees (31) selected stated that they were expert users in the current system prior to the company-initiated modifications. Interviews using qualitative methodology processes including conducting 3 weekly spaced interviews to allow participants reflection and correction of statements made. The participants were distributed between ages 20- 55, and equally balanced gender between males and females. All participants volunteered to be part of the study without remuneration.

Design

Participants were selected via convenience sampling at a mid-sized Florida based engineering firm in 2014. Following vetting and permission of participants, one-on-one interviews were conducted with 31 participants. Collection, and coding of data via qualitative methodology completed this study. Participants were responsible for driving the research via responses to open-ended, semi-structured questions. Key characteristics, events, and contexts of their specific information were recorded throughout the interview process for later coding [27]; [28]. The participants' direct quotations were sorted and categorized through tabulation by occurrence frequency. Understanding messages within participant's data required creativity and critical thinking processes to be properly analyzed [29].

This qualitative study collected data including the "voice" and experiences of the participants in unlearning typologies suggested by Rushmer and Davies [5]; [29]; [30]. According to Corbin and Strauss, "... Researchers are the translators of other person's words and actions" [29, p. 49]; [30]. This study process methodology was the vehicle of data collection and analysis [29]. Two phases were used to categorize data with open coding that identified areas of focus for each quoted response and categorization of occurrences. In the first phase, two independent coders sorted response data obtained from survey interviews [309]. Two rater analysis of open coding concluded with discussion and consensus. The second phase involved weak member checking.

In the first interview, results were recorded to the participants' experiences about their unlearning experiences during a computer system knowledge base change. Interview process quotations were coded [29]. Some participants produced more than one statement about their unlearning experiences and were coded.

In the analysis of the first interview, no reports of routine unlearning were collected. There were 64 participants' quotations coded using wiping

techniques to initiate their unlearning process. There were 39 participant quotations coded that identified using deep unlearning during their experiences. 4 quotes that were categorized as other as they did not relate to routine, wiping or deep unlearning categories and these experiences were not significant.

In the second interview, results mirrored the first interview. Again, quotes relating to unlearning experiences during an instigated change of previous skills were selected from the interview process with some participants producing more than one statement about their unlearning experiences. No reports of routine unlearning were coded. 43 of the participants' quotations discussed using wiping typology to describe their unlearning experiences during an updating of a computer system, knowledge base change. Results also categorized 13 participant quotations as using deep unlearning as their typology of unlearning.

The participants reviewed and confirmed information collected and interpreted during the final interview as the framework outlines. This allowed for creative interpretation on the part of the researcher, but maintained accuracy of the data collected from the participants' experiences [27]; [28].

Theoretical saturation was achieved by the end of the second interview, as there were no new emerging categories or significant new information. Monitoring the qualities of the typologies in relation to the data categories was essential to this study [29]; [30]. Each category achieved saturation at differing rates. A simple, weak form of a member checking with all participants quotations examined maintained consistency of data. It is in this re-analysis of the data characterizing unlearning using typologies, making this study unique.

5. Results and Discussion

The study consisted of collection of interview data quotations from employees about their perceptions during an organizational change process. Participant's descriptions of their unlearning experiences were overlaid on Rushmer and Davies' typology to develop a new unlearning conceptualization [5].

The participants were considered adept and experts using the current system and so that their actions had become routinized. With the system upgrade by the organization, participants were required to make modifications in their actions. Participant reported predominately wiping (107) and some deep learning experiences (52). The results are listed in Table 1.

Participants reported that most of their unlearning experiences were of the typology of wiping with 107 statements that reflected this experience where there was continuous change in procedures and actions. However, 52 participant quotes reflected a

deep unlearning where there was an abrupt alteration of mental models, and beliefs. There was an associated type of pain or upset [3]. The modification in their unconscious actions also included descriptions of confusion, frustration and emotional charge within their unlearning experience as outlined in wiping.

<u>Unlearning Typologies</u>	
Category	Interview# ½ Number of Quotations
	0/0
Routine Unlearning	64/43
Wiping	
Deep Unlearning	39/13
Other	4/0

Table 1. Results: Rushmer and Davies (2004) Typologies (adapted)

Examples of wiping typology, included knowing that change was required, and that this change was initiated by the organization as the system that they were currently using required an application upgrade. The realization that knowledge needed to be changed to complete job functions on the system was also described.

Examples of participants quotations included, Participant 2/1 who stated ... *“Just a lot of available information, a lot of available features and knowing that they were there and knowing that they could be accessed but not having the ability to access them. Kind of questioned my ability or felt behind the times when the company made this upgrade.* And Participant 5 reported: *“Well, the first thing you do is you go back to where you thought it was and then a lot of times (in the system), they changed the location or the naming of files.”* Participant 9/2 said: *“..., I mean there are certain tasks that I would have to hunt for to figure out how to do...a lot of things that I really didn’t know that the system could do... Just learned everything I needed from on-the-job training, and you pretty much learn it as you need it when your company makes the change.”* In all these participants, the typology of wiping was demonstrated to initiate the process of unlearning. Participants reported outside forces, their organization, modified their job process and initiated knowledge base changes in their work practices.

Deep unlearning, where frustration, confusion and a reflection that beliefs about their long-held work practices and processes required change were reported in 52 of the participant quotes. Here knowledge base was changed quickly and transformation was reported. In addition, abrupt alteration of their mental models,

and beliefs occurred with as associated type of pain or upset during the knowledge base change.

Examples included: Participant 1/2: *“I must have accidentally hit “yes” and it downloaded the upgrade... It happened fast and I wasn’t ready... and I was horrified because so many things went wrong. I wasn’t ready to change.”* And Participant 2/1 explained: *“Yeah, it was really frustrating and scary so much that I didn’t think I’d be able to find what to so” It changed my whole belief in my abilities.”*

Participant 2/2 stated: *“I, myself, felt overwhelmed all the time. Some days you just wanted to sit and just cry and go, what did I get myself into and that kind of thing... it changed my whole feeling about the work I could do.”* Participant 7 reported: *“I feel sometimes like frustrated and like desperate. There were so many changes that, like I said, unless you get used to it or know how to do it, it can be really tough. ... I know that, at the beginning, it was like a shock.”*

Participants related their experiences of change during their organizational updating. This individual unlearning is diagrammed in Figure 1. Due to their previous expertise, the use of tacit and explicit knowledge during the updating may appear to have a symbiotic relationship with both types of knowledge used to make change successful.

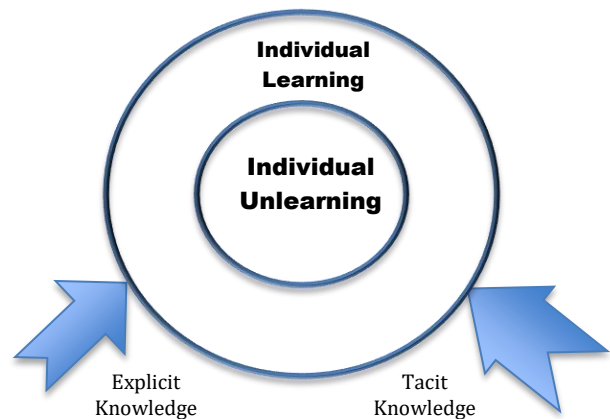


Figure 1. Individual Learning and Unlearning Model

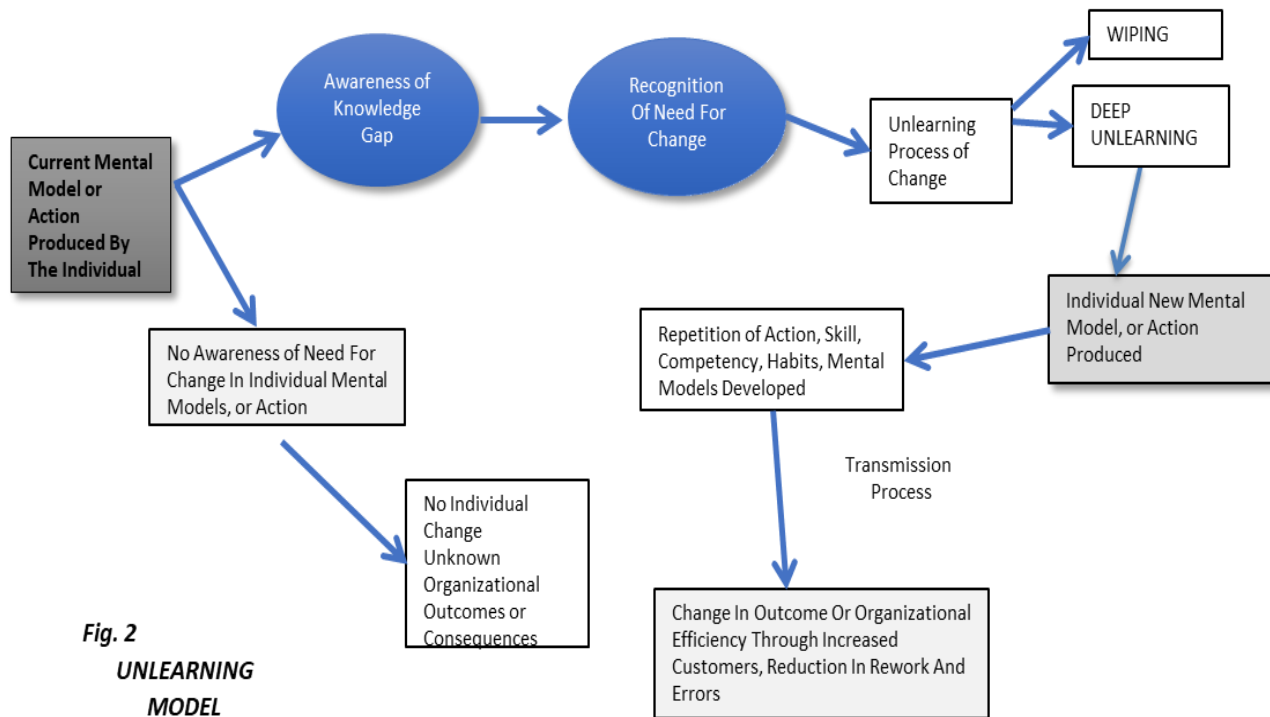
It appears that each process is required to complete a knowledge acquisition or change. It is yet unknown how the type of knowledge used affects these processes. Figure 1 displays postulated components of individual unlearning as it relates to the learning process and presents a symbiotic process.

Results indicated two typologies were reported. Table 1 lists results. Three factors were noted as trends, 1) an outside force was involved to initiate the process, 2) time for reflection and influence from outside and internal forces were needed during the

change. Required knowledge base change was initiated when awareness of outdated knowledge base was recognized, and 3) in deep unlearning, the speed of change required created emotional responses and can be compared to technological upset [3].

This company could no longer allow employees to use outdated systems in job roles.

Concurrently, an emotional component during the knowledge change was present in all deep unlearning experiences. Those that experienced



Additionally, three defining trends or characteristics of Rushmer and Davies' typologies were noted in this study. As the participants were experts in their use of the current knowledge, there was no need to make changes in their knowledge base until an outside force with influence was present. The company was solely responsible for initiating the knowledge base change. The first factor, an outside force drove the process of unlearning.

Secondly, when change in knowledge base was initiated, a step-wise process occurred. An awareness that change was needed, information was processed, and a realization that current knowledge was no longer useable. This appeared to soften and facilitate unlearning. When awareness of a new knowledge comes to the forefront, change appears deliberate and new knowledge, which can no longer be ignored, in relation to current competencies, is adapted.

Thirdly, a rapid change or break from past actions or behaviors occurred in some participants.

technological upset and other emotional responses, were more likely to express the idea that their knowledge base change questioned and disturbed their mental models and the process of unlearning was more difficult to complete [3]. Figure 2 displays the components of individual unlearning as it relates to the learning process with a symbiotic process relationship in Figure 1.

Figure 2 displays the components of individual unlearning as it relates to the learning process whereas, the symbiotic process relationship of individual learning and individual unlearning is presented in Figure 1.

From study results, the model in Figure 2 is proposed to further clarify the process of unlearning. The current mental model or action is updated initially by an awareness and recognition. Change depending on type and speed of initiation occurs using wiping or deep unlearning. A new mental model or action is produced through repetition and knowledge change is realized.

6. Summary and Need for further research

There has been limited study regarding the processes of both organizational unlearning and the unlearning in individuals working in organizations. Literature about the unlearning process currently exists across many disciplines, but not in enough empirically based studies. Although information regarding organizational unlearning has contributed to knowledge innovation processes, the existing research about how unlearning in individuals occurs remains limited [3], [10]. The idea that an individual should ... “eliminate preexisting knowledge or habits that would otherwise represent formidable barriers to new learning” has not been established [18].

Researchers have not been able to gain consensus of differences between learning, unlearning, and other acquisition or release processes. There is not consistency in terms of type of knowledge and environmental conditions to characterize unlearning processes. Disagreement within current literature about the scope of unlearning in individuals has not been well defined especially in knowledge management involving conscious, and regulatory tasks versus the automatic, routinized type knowledge change tasks.

This research provided a different perspective of typologies within the complex process of unlearning. Unlearning may be represented in different typologies as well as levels. Rushmer and Davies’ three types of unlearning include routine, wiping, similar to behavioral change, and deep unlearning similar to cognitive change with transformational, rapid, emotional alterations in previous procedures. How topologies of unlearning within the context of new knowledge change for employees, will provide and impact organizational effectiveness is yet unknown.

Future research should add to the knowledge of the unlearning process through diverse participants, and research methodologies. Variations in the work functions, geographical locations and rationale behind the needed change of knowledge base would also be of value. Researchers need to look at the process thought a variety of lenses and concentrate in developing effective identification of successful unlearners. Research needs to continue to focused on types of unlearning and define specific parameters of the process. Questions remain: How and why does the knowledge change occur? Where does change initiate; internal self-regulation or outside force? What type of knowledge are susceptible to unlearning? How stable is a knowledge base when confronted with change opportunities? Questions such as these are unique pieces of the unlearning puzzle require further investigation.

The further refinement and understanding of the process of unlearning and its unidentified typologies continue to be of value in targeted training methods and competency maintenance during the

continual organizational change. Unlearning continues to have far-reaching implications in knowledge change processes within organizations impacting training programs, knowledge management processes, and organizational leadership strategies. It is for researchers to assist in this endeavor and forge the path between empirical study and practical application.

7. References

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