Computer System Unlearning in Individuals

Julee H. Hafner
The Chicago School of Professional Psychology
jhafner@thechicagoschool.edu

Abstract

For employees, additional processing, retention and acquisition of specific knowledge to perform tasks is necessary to remain current. Continual computer modifications have created difficulties for individuals who must unlearn, store and use new knowledge processes to update the old. The amount of wasted time, additional energy and resources required increases when actions fail to be updated through unlearning. Confusion regarding the unlearning process remains a persistent problem because research has been limited and uses inconsistent or anecdotally based definitions. This qualitative study: 1) collected descriptive unlearning characteristics; 2) proposed a definition of the unlearning process in routinized computer actions. 93 weekly-spaced interviews with 31 participants were collected and categorized the process into unlearning experiences and perceptions. One Hundred-Seven participant quotations referred to Experimentation in unlearning of their old Window system/application. Perceptions focused on feelings of Technological Upset versus Technological Ease during unlearning. In addition, participants suggested unlearning is facilitated by the availability of support, experimentation opportunities and reduction in time constraints. From study results, unlearning was demonstrated as an important concept required during the updating and specific knowledge acquisition of computer interfaces.

1. Introduction

This paper presents the results from previously proposed study presented at HICSS-47 and reports results of knowledge change processes, or computer interface unlearning [1]. Modification of current knowledge base to successfully perform tasks without errors has become an important focus for organizations [2]. As knowledge grows exponentially, the ability to maintain competitive advantage becomes difficult for both organizations and individuals alike. Organizations must change rapidly by altering actions, behaviors and “mental models” within employees [3]. The challenge is to develop and implement new knowledge to update individual current competencies [4].

Knowledge is created and maintained with “knowledge organizations” [5]. This results in a competitive advantage. Competitive advantage requires increase in knowledge, and the ability to modify knowledge efficiently. Technological advances and changes in business conditions require continual updating resulting in an increase in work pace [6].

Organizations such as Hewlett-Packard and Coca Cola are attempting to improve their skills in capturing and sharing knowledge. A survey of fortune 500 companies suggests only 4 out of 200 companies are only beginning to realize the value of knowledge [5]. To have the ability to acquire individual knowledge and use intellectual capital are important resources to create these ‘knowledge organizations’ [7].

Currently, both the process and the characteristics of knowledge acquisition and knowledge change are not well understood [8], [9], [10]. Organizations and their members must learn quickly and effectively to produce new actions. However, changing knowledge involves altering both the individual and organizational competency base to use this new knowledge. Researchers are uncertain how knowledge is updated [11].

As the amount of information increases, knowledge becomes difficult to manage. The acquisition and maintenance of current competencies can help keep unplanned operating costs and production time to a minimum. For organizations that rely on speed and accuracy of service delivery, this ongoing knowledge updating is equated to maintaining competitive advantage in the marketplace. Implementation of any new process for employees may result in added time to complete new job functions, increased errors in work product resulting in increased operating costs for the organization.

Whether “unlearning”, a change from prior knowledge to new knowledge, involves a replacement, disuse, or another process has remained undefined by current research. The confusion about the characteristics of unlearning involves anecdot al evidence and lacks empirical agreement about the specifics of the process. The acquisition, refinement and change of basic employee competency present an ongoing problem for organizations [5], [12], [13]. Previous behavior and old knowledge requires updating [14]. Attempting to acquire and maintain current knowledge involves transmission of knowledge from the organization to the individual [3], [13].

Conforming to numerous procedural changes, the processes to acquire knowledge needs further investigation [9], [15]. With individuals responsible for completing new tasks, the strategy of how to change or “unlearn” previous actions and produce new knowledge competencies is of interest. Undergoing knowledge change and developing competencies with that knowledge is an ongoing problem [14].
Unlearning has been defined as, the process of disuse or replacement of an action, procedure or belief in favor of a new one [16]. Understanding of unlearning is a valuable resource in knowledge change and management. To acquire knowledge, successful behavioral patterns are solidified into the individual’s unconscious through repetition [8]; [9]. With the introduction of new unconscious actions, automatic or habituated actions are developed through their consistent usage and are central to the unlearning process. What the impact of this unlearning change process is on knowledge management remains undefined.

The following research question was investigated in this study:

*What are the experiences and perceptions of individuals during unlearning in their job roles?*

## 2. Relevant Literature

Much study has involved the learning process, however unlearning may not use exactly the same procedures. With ever-increasing demands on the retention of knowledge in workplace settings, what to do with unused knowledge presents a problem for systems involving memory, retrieval and storage [17]. It has been speculated that storage of knowledge is a problem central to unlearning [18]. Unlearning may be considered a cognitive-based process whereby old knowledge may be used or not [18]. The retained information triggered by the appropriate situation is available for use. Thus, knowledge utilized depends on the need or purpose and may be association-driven.

Individual unlearning may involve total removal of old knowledge [16]. This suggests that unneeded knowledge is erased. Individuals begin with a “clean slate” before adding information [19]. This thinking has been discounted as faulty, suggesting knowledge cannot be added to or erased infinitely [20]. When adding knowledge continuously, the “clean slate” hypothesis suggests the human brain is expansive enough to store, process and access vast amounts of data without exceeding capacity [19].

When new knowledge is available, old information could be discarded whereas, old knowledge could also be viewed as incorrect information no longer accessed following a knowledge change process [16]; [17]. Employees acknowledge previous behavior is now unreliable and stop using it due to this realization [17].

The underlying assumptions or frames of reference of the individual during unlearning and change may impact the success of the process [21]. When knowledge is acquired, it is added to individual knowledge awareness, but this knowledge is not necessarily accessed or utilized.

How old unconscious behaviors, specifically in the area of retrieval and use, or storage and disuse are changed may be a function of the unlearning process [20]. When a process is being modified, we may actually not be aware that we have stopped learning. 70% of this unconscious or automatic learning makes up all adult learning [20].

Due to the vast amount of knowledge added on a daily basis, an individual must find a way to use the information when needed. The storage system may involve retrieval according to [18] however, others suggest that there are specific storage strategies during the learning process involved. This would suggest that making room for new knowledge and accessing old information would be important to the concept of unlearning [22].

It has been reported that the process of unlearning involves replacement of information, whereas, it can be stated that knowledge remains, but is no longer used until a situation requiring previous knowledge presents itself [23]; [24].

One method to circumvent these difficulties is to allow for combination of knowledge elements for ease of use. Cognitive load theory (CLT) introduced the idea that there was a complex relationship between the information and the individual’s ability to acquire knowledge within the learning environment [25]. The change process during unlearning requires the storage and access of the new knowledge and may occur differently [15].

Another method to deal with storage problems during knowledge change is automation. “Redundant information can be instrumental in speeding up knowledge creation” [8]. It is specifically through the reproduced performance that an activity can become an unconscious task for habit creation.

When knowledge becomes automatic or routinized through practice, the capacity of working memory is not needed [15]. Working memory now can focus on other activity. However, automation requires consistency in repetition and specialized storage and retrieval systems [26]. The “storehouse” view of knowledge acquisition allowed for identification of the needed information and provision of the training and feedback needed for learning change to occur [26].

Research has not determined how unconscious behaviors are processed, managed and stored for later use. Automatic behaviors may be the product of successful knowledge change [10]. If the process is disturbed in some manner, unlearning may be unsuccessful.

It has been suggested unconscious replacement in unlearning occurs without awareness [20]. Tasks performed on a daily basis become routine over time. This behavioral repetition within a similar context accounts of approximately 45% of daily actions [20]. “This redundancy also facilitates interaction among organizational members and makes it easier to transfer tacit knowledge among them” [13]. When unlearning is incomplete or unsuccessful, errors in actions may
result. Employees who perform routine tasks can make errors as a result of a change in habit behaviors consistent with change in the unlearning process [4], [14].

Changes in these routine behaviors from organizational mandates may contribute to an increase in errors. Levels from the low-level close approximation type errors, such as the miss-writing in medical documentation to the highest level with consequences of errors even resulting in death are possible [29].

Another consequence of these unlearning errors occurs when machines are used in organizational tasks. Through continued use, workers develop rote actions in operating equipment. When a newer model replaces the equipment, the old rote behavior may not be accurate in operating the new machine. This change is a source of reduced work output or errors in production. It can even result in breaking the new piece of equipment due to command errors.

Consider the widespread use of computer systems in organizations. They are employed in every facet of business. Computer systems process orders, manage inventory, control banking transactions, make reservations for air travel, hotels and autos, manage the power grid and patient health as examples of the breadth of the use of systems in business operations. In practice, these systems are continually upgraded with new software versions or replaced with systems to more closely support business functions. Many of the users develop unconscious or rote behavior when operating equipment. These changes require that operations staff and users continually revise their mental models and operational processes in using new versions.

Understanding knowledge acquisition techniques could prove useful to individuals. During change processes where actions are already in a state of flux, such as in organizational transformation, understanding error production resulting from unlearning may prove useful [17]. A connection between persistent learned techniques and error incidence, especially during periods of organizational transformation suggests the input of information and knowledge needs to be able to flow from education and training sources to the individual [10]. When the individual allows the new knowledge to be processed, comparison and awareness of the inconsistencies occur. From this point in time, the individual begins the knowledge comparison process with recognition of the gap between previous and current knowledge.

3. Research Method

This study involved three one-on-one interviews spaced one week apart per grounded theory based methodology and specific interview processes [30]. The interviews involved open-ended, semi-structured questions, researcher observations and notations. Data collection commenced following interface changes within the previous 6-9 months. Weak member checking allowed the participants the opportunity to add, correct and confirm interview data. Participant confirmation and validation insured the completeness of the information provided during the research study.

The study focused on unlearning that involved a change in computer systems or a computer application. A midsized engineering firm provided 32 participants for this study. The organization instituted a change in their Windows environment creating the need for unlearning of routinized actions. The specific change in computer systems involved old systems or applications, such as Windows XP, Windows 7, Microsoft Word 2007 or the application AutoCAD with a change to Windows 8, Microsoft Word 2013 or an updated version of AutoCAD applications. The updated systems involved new graphics and user interface that had significant revisions.

These system application modifications made the previously used automatic motor movements ineffective in the operation of the upgraded system or application. This was considered a revision to the knowledge base where the current skills had become obsolete and unusable thus, focusing the data on collection of unlearning in knowledge change. In addition, these specialized employees stated that were expert users in old Windows/Word systems or AutoCAD application and routinely used the system to the point that actions were routinized.

4. Results

Ninety-three interviews were conducted with 31 participants. Of the 32 participants that were selected to participate in the 3-interview process, 31 completed all of the interviews. No participants requested to be withdrawn from participation. One participant completed only 1 interview and was removed from the study. The total number of participants completing the entire study was 31.

The results from the interview process collected and coded one hundred-seven participant quotations who stated they used Experimentation to begin unlearning. Three subcategories of unlearning strategies were indicated: 1) Unstructured Experimentation, 2) Structured Experimentation, and, 3) Resource-Based Experimentation. The remaining 23 responses did not specify a type of unlearning used. The breakdown of participant responses are listed in Table 1.

Unstructured Experimentation is defined as a type of “trial and error” without a planned strategy to determine the functions of the computer system or application. Twenty-nine participants used the unstructured approach with 16 participants in Interview 1 and 13 in Interview 2 reporting this strategy. Participant 4 discussed her experimentation strategy of Unstructured Experimentation. “I have to try things, okay, let’s try this and see if this works,
Resource-Based Experimentation

This participant, used Unstructured Experimentation to attempt to identify and produce changed actions. This was this participant’s method to experiment with a new system, trying different functions, waiting for the correct result during the unlearning process. This participant had expectation on how the new application would work during her Unstructured Experimentation process when unlearning the previous system and learning the new. When expectations were not met, frustration occurred.

Participant 18 [I-2], stated her Unstructured Experimentation in this way, “…Trial and error method… you know… hit a bunch of buttons or mainly use my mouse to hover over things to get the answers to see what that did”. This participant perceived that getting through the unlearning process occurred in a random pattern, or was unstructured.

Structured Experimentation was defined as a defined as “learning by doing”, where the activities were specific to complete a job task using the system or application and has a planned strategy. Fifteen participants mentioned this strategy with seven in the first Interview and eight in the second Interview. In this approach, participants were more aware of the processes that produced unlearning of the new system. For example, Participant 12 discussed Structured Experimentation strategy stating, “I would learn by doing it, had I done the task before? ... have I cracked the code before?, did I do a reference of knowledge?... [I-2]. This participant was able to do much Structured Experimentation and self-questioning to progress her unlearning of a new system.

Another participant, 6, mentioned and described the Structured Experimentation needed to complete the job task. “I mean, I don’t know if it is because I’m getting used to the differences or I’ve got some hands-on decisions and I’ve learned how to use it now. But, I think, just at the beginning, it was a little bit tough to work with” [I-2]. This participant conveyed the difficulty of change in work tasks. However, Structured Experimentation allowed the unlearning process to occur more easily. According to this participant, getting used to different knowledge was difficult and the Structured Experimentation approach gave a “hands on” experience to make the transition easier.

Resource-Based Experimentation, was coded as the predominant description with 40 participants using this strategy. Twenty-one in the first Interview and 19 in the second Interview reported this strategy of unlearning. Resource-Based Experimentation was defined as a type of “figuring it out” where the employees used an Experimentation strategy and supportive resources, such as documentation, help from coworkers, or technology, such as HELP functions and Google.

These participants discussed initiating their unlearning process similarly to other participants using Unstructured and Unstructured Experimentation. However, these participants chose to utilize a variety of additional resources to complete the job task. These additional resources may include using knowledge from others, using ancillary materials such as books and manuals or using interactive tools such as the Internet (Google), or HELP functions to complete their job task. Participant 4 [I-2], gives an example of her use of Resource-Based Experimentation to complete the unlearning process, “…I just looked at the reference book to help me out.”

The use of Resource-Based Experimentation was essential to making the needed unlearning of a new computer system more effective. Participant 29 states, “If I haven’t figured it out… I just…I need to bring in somebody else to help me is what I realize, and the person that I bring in most of the time is really fluent on it, does it all the time, they’re able to do things in maybe an hour or two that might have taken me a day or two” [I-1]. The participant had a new awareness that the approach that was currently being used may not be as efficient and additional resources were needed. For participant 7, resources were added in a variety of ways. “…Just sometimes Google it, sometimes ask a person, but it would better if we get some tutorial or something… classes, but we don’t have that here, we just have to Google it or ask someone…..” [I-2]. The reliance on many modalities was a realization that others might have the same issues. The collected data for these unlearning experiences were coded, tabulated, and reported in Table 1.

Transcripts also showed participants’ perceptions changed throughout the process of unlearning. Employee perceptions, defined as the feelings and emotions that the participants related regarding their unlearning of new technology through the interview process were coded as the category of Employee Perceptions. Responses were grouped by their similarity. Negative response perceptions were labeled as the subcategory of Technological Upset. The most frequently mentioned type of upset stated by the participants was frustration, with 25 quotations in the first interview and 11 in the second interview [25/11]. The other perceptions collected during the interview process were stress / anxiety, perceived in eight participant responses (five in Interview 1 and three in Interview 2), and five participants perceived overwhelm (5 in I-1 and 0 in I-2) and four noted confusion (4 in I-1 and 0 in I-2).

Frustration appeared as the main negative perception involving an emotional upset about the unlearning process. Participants discussed their concerns as a generalized upset, unbalancing their competency and old knowledge base in the completion of job tasks. Participant 30, Interview 1 stated, “…if I didn’t find them in the next couple of minutes, there is a level of frustration especially when it’s not something you use every day”. The participant had
expectation on how the application would continue to work even though there was need for unlearning.

When the current knowledge did not work, frustration occurred. Participant with the assigned number of 32 stated, “...but, when it wouldn’t do what it did before it gave me a bit of angst until...uh, it works because that’s the way I’ve always done it and it should work” [I-1]. Participant 18 explained the perceptions of overall upset due to the technology that was being unlearned. This participant noted a variety of emotional responses that best explained many of the participants’ perceptions [I-1].

Other quotation responses were varied, without a pattern, and represented 12 different perceptions outside any available category. An example of this Other category response included, [P-5, I-1], who stated, “Kind of like driving home,..., I don’t remember getting home or the drive.”

The next identified subcategory of Individual Employee Perceptions was Technological Ease. Technological Ease was defined as the collection of positive participant perceptions following the completion of the learning participants. Technological Ease was coded in 54 participant quotations. Twenty-six stated this ease in Interview 1, and 28 in Interview 2. The predominant perception ease type was comfort, with 29 of the respondents, 19 in Interview 1 and 10 in Interview 2. Other perceptions responses included, task competency and confidence with eight responses (3in I-1 and 5 in I-2) and four responses (3 in I-1 and 11 in I-2) respectively. Other quotation responses were varied and represented six different perceptions in Interview 1 and seven in Interview 2. An example the Other category included [P-2 I-1], “It was like I stepped into the 21st century, it was fast and the graphics were so much better and brighter and it was amazing, just better, totally better”. A breakdown of the participant perceptions are summarized in Table 2.

The participants that were able to respond with a positive perception appeared more at ease with the unlearning process. The understanding of their job tasks and the perceptions of competency during the process of unlearning helped the process overall. In Interview 1, Participant 9 discussed this competency by saying, “I'm between a learner and confident. I'm confident in what I need to do, like some basic tasks...so, I can do what I need to do now, but, but I still have a lot of learning to do...”

With the unlearning process, there was a change in comfort and confidence level of this participant. This was evidenced through a change in vocal tone and body language to a more positive state. Another participant knew the results of the unlearning process and that Experimentation strategies were no longer needed allowing the participant to feel comfortable.

I feel that I can get things accomplished through doing it, and it makes me feel good but...I had to learn it, then everything was difficult, yeah, but now I already know all the commands that I use and I feel confident, you know, I don’t worry about it. I feel safe again, I feel comfortable, I’m happy again because I got it the way I want it [P-24, I-1].

This participant noted difficulty with the new knowledge, but appeared to push these perceptions aside for current competency operating the new Windows system. This entailed a perception of increased comfort and safety when completing the job task. This participant was able to accomplish work tasks without the original anxiety and worry.

Another participant, [P-31, I-1] also suggested that there were other factors that added to his feelings of competency, time to experiment and the support of others that assisted in unlearning.

Yeah, I would say I'm pretty competent. I'm fairly proficient. I feel like a lot of it, and this isn't probably necessarily knocking anybody, but the age factor too, I think, helps a lot. We've grown up, I've grew up using computers a lot. I can understand the difficulties with maybe the older generation, that these programs change all the time but for me, it's kind of seamless [P-3; I-1]

In these examples, all of the participants positively acknowledged unlearning in task completion. The experimentation phase was used, but “things” were now in the “right” places. Due to this perception of competency, the participant was able to feel better during the unlearning process. Feelings were characterized as, “good, now everything is in the right place, and I feel comfortable” [P-13, I-1]. There is an added sense of comfort with the tasks [also in P-7, I-1], who stated,

Right now, It’s like, I’m comfortable and happy using it because, like I said, I think it is once you get used to it and know how to use it, it is like, and they’ve got some shortcuts I think, in my opinion, once you know where they are at and how to use it, I think they’re better than the old system.

In the unlearning process, there was a noted change in comfort and competency levels of the participants. The unlearning in this participant begins from previously routinized action. She unlearned what to relinquish from her outdated knowledge and a perception of comfort was the result.

During data collection using grounded theory methodology, participants noted similar characteristics of the process of unlearning in the change from old system or applications to new. Theoretical saturation had been reached by the end of Interview 2 and therefore, Interview 3 was not added to the total response tables. The interview responses from coded data for experiences and perceptions are summarized in the Table 1 and Table 2:

3864
Table 1

<table>
<thead>
<tr>
<th>Experimentation Category</th>
<th>Total Responses</th>
<th>Reference (Interview 1)</th>
<th>Reference (Interview 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstructured Experimentation</td>
<td>16</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Structured Experimentation</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Resource-Based Experimentation</td>
<td>21</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

This table lists results of Employee Perceptions of Unlearning from Interview 1 and 2.

<table>
<thead>
<tr>
<th>Perceptions</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological Upset</td>
<td>76</td>
</tr>
<tr>
<td>Frustration</td>
<td>36</td>
</tr>
<tr>
<td>Stress/ Anxiety</td>
<td>4</td>
</tr>
<tr>
<td>Overload/ Overwhelm</td>
<td>5</td>
</tr>
<tr>
<td>Confusion</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
</tr>
<tr>
<td>Technological Ease</td>
<td>54</td>
</tr>
<tr>
<td>Comfort</td>
<td>29</td>
</tr>
<tr>
<td>Competence/Adequacy</td>
<td>8</td>
</tr>
<tr>
<td>Confidence</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
</tr>
</tbody>
</table>

It appeared the participants required a form of confirmation in the Experimentation process by more knowledgeable coworkers, who had experience with a computer application.

Others used technological support, I-8 (10 in I-1 and 8 in I-2) participants used the support of Help, Google and other Internet sites. Some participants made changes using the Internet, specifically Google where there is support from similar unlearners.

2. Time constraints were defined as the limitations on the amount of time required for the unlearning process. This became the second subcategory of the Factors of unlearning and was mentioned by 24 (19 in I-1 and 5 in I-2) participants. The participants responded with information about the lack of the time to Experiment and to discover functions. The participants also added the perception that the process was problematic due the required productivity in job task completion.

One participant suggested the unlearning of a system made his job tasks more difficult. He noted that there was a change in the perceived amount of time needed to finish a task with the unlearned system.

“I spent a lot of time searching for the same functions. They were definitely still part of the software, it just had been moved to an entirely different place, the thing that was simple and straight forward I felt I used half the day kind of searching for how to do things” [P-21, I-1].

In Interview 1, Participant 9 suggested that there was a need for task completion within a specific time period that added to difficulty in producing unlearning.

“Yeah, it was the initial opening and thinking... Oh no, this is nothing like the other one and I have to get this
done now” [I-1]. Other participants, noted how they are functioning through the unlearning process. Participant 22 expressed, “Yeah, it’s definitely, over time, it is getting a little easier but it’s still, I catch myself every now and then, just like “oh, yeah, I’m in the wrong spot, it’s not there”. [I-1]. Participants felt that time constraints had an impact on their ability to unlearn the old system.

3. Twenty-five participants stated that their Opportunities for experimentation involved the use of strategies of Experimentation to facilitate change. Experimentation added to their knowledge and assisted in the development of the perception of comfort in their job tasks. These opportunities afforded the participants in their unlearning.

The participants also noted that their unlearning process was easier when they were provided with the Opportunity to experiment with the functions of the system or application that were not specific to their job task. Participant 29 [I-1] suggested,

There are certain functions that I can do without even thinking twice about it. There are others where, because I don't use it, it depends on how often I use it, so if I use a certain function often, it's pretty simple [P-29, I-1].

Some participants wanted to experiment in advance for future actions and wanted additional Opportunities to experiment. Participant 1 unlearned through Experimentation to facilitate the knowledge change process.

Once you get used to it, just like anything, you learn the new tricks and the nuances and you get used to using it all the time, I like it. I mean, obviously, they wouldn’t make improvements unless they felt they were truly that, improvement [P-1, I-1].

In this quotation, the participant mentioned the added knowledge resulted from the opportunities to experiment and developed positive perceptions. These responses were summarized in Table 3:

<table>
<thead>
<tr>
<th>Factors in unlearning</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant Terms</td>
<td></td>
</tr>
<tr>
<td>Time Constraints</td>
<td>24</td>
</tr>
<tr>
<td>Opportunities for Experimentation</td>
<td>25</td>
</tr>
<tr>
<td>Availability of Support</td>
<td>101</td>
</tr>
</tbody>
</table>

The following definition is proposed as a conceptualization and as a result of the data analysis hand coding process that answers the research questions of this qualitative study:

Unlearning is the process of using experimentation and available resources to produce knowledge base change.

The results point to unlearning as different, although similar process from learning. This process is affected by whether specific factors are present during the individual unlearning process.

5. Discussion

Initially, attempting to understand unlearning and how it differs from learning involved collecting the data to identify what participants understood about their ability to disuse current knowledge in order to make way for new knowledge. However, the overall sentiment of the participants suggested that their process of unlearning was in fact a different process than learning, although most found it initially difficult to relate in detail. However, the participants’ were able to relate some important concepts essential to understanding the unlearning process during system or application change. Responses in Table 1, 2, 3 summarized the ideas and thoughts of the participants discussed during the interview process.

The participants identified using Experimentation as a central point to begin unlearning. Three experimentation strategies of, Unstructured Experimentation, Structured Experimentation, and, Resource-Based Experimentation allowed the participants to complete the unlearning process. The lowest level, Unstructured Experimentation, described by participants as merely pressing buttons or trying functions without a plan helped them determine what to do in a task. In the next level, Structured Experimentation, the participants were more methodical, selecting out functions and using some strategy to complete their unlearning. In the highest form, Resource-Based Experimentation, the participants were using all of the easier strategies available and adding additional resources to complete their unlearning process. The participants were able to develop new skills in any one of these methods, with Resource-Based Experimentation being the predominant and most effective form of Experimentation.

Although familiarity with previous task was part of the reported population selected, the participants all described their current knowledge base as impacting knowledge change. Their need for experimentation and supportive assistance to stop performing old automatic actions used in their specific Windows interface was essential to completion of the process. Almost all of the participants mentioned that changing knowledge by not using the old was difficult for them.
to do. This is why many reported *Technological Upset* to varying degrees.

Three *Factors* were identified as having an impact on unlearners. The *Factors of,* *Availability of support,* *Time constraints* and *Opportunities for experimentation* were the most prevalent in the quoted responses from interview data. These three factors appeared specific to the individual unlearner and involved the environmental context of the work tasks.

*Availability of support* contributed to the perception of technological ease, in job tasks. Some participants reported using *Experimentation with self-support* with uncompleted tasks resorted to the support of other methods. Often participants used this type support for unlearning initially. These participants noted more technological upset than those that relied on other types of support. Participants required others to confirm new unlearning skills. The participants that were able to perceive support from others, the HELP or Google appeared more likely to report a positive feeling and experience unlearning as less frustrating.

Participants also noted *Time Constraints* had an impact on their ability to unlearn the old computer system or application. Those participants that were time challenged reported more upset and have negative perceptions. The participants discussed the lack of time as a hindrance to effective unlearning.

*Availability of Opportunities for experimentation* helped complete the process of unlearning by participants. The participants noted the *Opportunities to experiment* with the computer system or application provided a wider knowledge base and increased positive perceptions. The participants suggested their knowledge base was increased through *Experimentation*.

Those with additional *Experimentation* opportunities were better able to complete their unlearning. Those employees initially felt a negative perception of upset and frustration at not being able to successfully perform a job task that had been easy earlier. The employees that had these perceptions often related perceptions of incompetency and inability to complete job functions. These perceptions, although not quantified, may add to the understanding of productivity changes in specific job functions.

When describing learning of the Windows update, the participants viewed this process as different due to the fact that there was a starting point or referent for unlearning. This referent, or prior knowledge, allowed participants to function competently in their old job tasks. A referent of specific computer knowledge made the unlearning process easier.

With requirements made by the organization, employees needed to modify knowledge or actions to remain competent. Employees struggle to complete these new tasks effectively. However, employees that changed automatic actions more easily were able to update their knowledge base about the Windows system or application. The overall sentiment of the participants suggested that their process of unlearning was, in fact a different process than learning, although most found it initially difficult to relate in detail. Confirmation of the presence of unlearning came through the participant affirmations of collected data. Many participants suggested familiarity with similar tasks during change made unlearning easier. The participants all described their need for experimentation and supportive assistance to stop performing old automatic actions used in their previous Windows interface. Almost all of the participants mentioned that changing knowledge by not using the old was difficult for them to do. This is why many reported *Technological Upset* to varying degrees.

In this study, the participants were faced with a change in their current knowledge. The process to replace existing knowledge was reported by the participants as different from normal learning. Unlearning began from previously acquired knowledge. Knowledge that was acquired and became routinized, made change difficult [8].

Two participants noted these summarized these essential differences and related the unlearning experience:

… um, the second system, I noticed some things that I used to do in my old system or software that I could no longer do… [P-8, I-1].

... what I once knew was no longer there and you spent so much time learning that and you’re an expert in it, so you think you are, and then they switch it right on you and you’re like, well now I’m back to ground zero [P-18, I-1].

The participant interviews related how they understood the Windows system or AutoCAD application. They were familiar with the routines and what was involved working with these computer interfaces. In this case, the individual already had the essential knowledge stored for needed actions. The individual had to create specific conditions where change could take place and new knowledge could be replaced. Further research of unlearning is needed to develop this relationship.

A few participants used words such as, transition, updating, evolution and replacing as descriptors that identified their unlearning experiences during a change of a Windows interface. Although not numerically significant, it does provide some view into the need for future research to establish a concrete description.

It is the conclusion of this study that unlearning is a different, although similar process to that of learning. Unlearning contains strategies and factors that impact the process of changing knowledge. Employees possess knowledge and use that knowledge to discover what changes are required. It remains difficult to
release old routinized knowledge in favor of new knowledge [8]. It is through experimentation that the employee is able to determine what the faulty actions are and acquire the new competency.

The results of this study point to unlearning as a process affected by factors specific to the employee undergoing change starting from a previous knowledge base. New competencies can be developed effectively using techniques derived from understanding of this knowledge change process. This may have implication on implementation of training presentations of new systems or applications by organizations. The availability of resources and the time to take advantage of the discovery processes that are involved in experimentation can assist the employee who needs to unlearn. It was demonstrated that unlearning is a unique process necessary for effective knowledge change.

6. Need for further research

This research provided a better understanding of the complex process of unlearning and how it may differ from the learning process. The inherent complexities of unlearning are presently not well understood, making this study excellent for continued research. Literature that currently exists about the unlearning process has been not been empirically based. Limited literature across many disciplines have begun to examine unlearning, but study has largely has consisted of many inconsistencies across disciplines. This empirically based study has added to knowledge on the characteristics of unlearning in computer-based employees using computer systems and applications.

With additional study, researchers can concentrate in developing effective identification of successful unlearners and develop targeted training methods to maintain competency for organizational competitive advantage. To remain competitive, organizations may consider the results of this research in their training and knowledge change processes.

Future research should complete additional studies to add to the knowledge of the unlearning process through different participants, different researchers and different interview methodology. Using different participants from diverse work functions and geographical locations would provide for additional diversity and represent the population to a greater degree.

Additionally, future research should examine unlearning categories using different methodological constructs to add experiences, perceptions, and factors in the process. Through case study methodology, additional contextual information of the process of unlearning in organizational employed may be collected. Through quantitative survey methodology, increasing the range of participants available for study would provide additional data to better understand the process of unlearning. In addition, survey methodology may be useful in quantifying the rich data collected in this study that had been a previous limitation of early theorists in the area of unlearning.

Unlearning appears to have far-reaching implications to learning change in a variety of fields of study, especially impacting computer training programs, knowledge management processes and leadership strategies. To acquire and internalize task competencies, unlearning skills are required that differ from learning strategies. Because adults create and use a variety of types of knowledge, change processes become critical. How unlearning is explained within the context of new knowledge introduction for employees will have continued impact on organizational effectiveness.

7. References


