An Analysis of Dynamic Misconception in Saudi Female Graduate Students' Use of PowerPoint

Enas O. Sarour

Department of Family Sciences, King Abdulaziz University, P.O. Box 645 Jeddah 21421, Saudi Arabia
isoroor@kau.edu.sa

Abstract: This article examines dynamic misconceptions and conceptual change in technology behavior in the context of a study conducted to 13 Saudi female graduate students regarding their misconceptions about PowerPoint and the interventions used to correct these misconceptions. A conceptual change model is adopted to measure any shift in belief after intervention. A pilot study was conducted to verify the validity and reliability of the belief instrument. The results indicate positive outcomes in conceptual change and technology behavior. The study confirms "misconception" as a pre-determinant of misuse, and recommends that "misconception" be included in change models to better explain usage behavior and resistance to change.
[Enas O. Sarour. **An Analysis of Dynamic Misconception in Saudi Female Graduate Students' Use of PowerPoint.** *Life Sci J* 2014;11(9):280-292]. (ISSN:1097-8135). http://www.lifesciencesite.com. 39

Keywords: conceptual change, dynamic misconception, training, innovation, adoption

1. Introduction

Technology affects the way we communicate, influencing every aspect of our lives to the extent that today's youth cannot imagine human existence without it. Thanks to innovations in mobile technology, college students use technology vastly different from even their recently graduated peers; such students are "digital natives" who, unlike previous generations, do not need to adapt to technology (Prensky, 2001). Rather, for today's students, "...technology is not just a tool, but a 'fifth' language taking its place alongside speech, writing, mathematics, and science" (Office of Educational Research and Improvement, 1998, p. 4). However, similar to these other languages, misuse of technology is prevalent.

In a world where technology is as deeply integrated into higher education and work as it is into our personal lives, misuse in practice can lead to miscommunication. It is no wonder, then, that college graduates are expected to be able to effectively integrate technology into their academic and professional careers. In fact, the use of technology in both the classroom and workplace has become so commonplace that mobile devices are now critical communication tools. However, in considering this context, one should take into consideration not simply *what* forms of technology are used, but *how* today's graduates tend to use technology, and what latent beliefs guide technological practices, shape future practices, and affect education, business, media, and research arenas (Alfahad, 2012). With five generations occupying today's workplace in most developed countries, managers continue to struggle to close gaps in communication, cultural, and technological proficiency.

Defaulting to PowerPoint

One form of technology that has become conventional over the last 20 years is Microsoft's presentation tool, PowerPoint. For most of its lifespan, PowerPoint has occupied a unique role in aiding the communication process, and continues to occupy 95% of the presentation tools market. PowerPoint has made a similarly strong showing in educational settings, demonstrating explosive growth in the past 10 years.

However, citing its ubiquity in classrooms and corporate meetings, critics warn that PowerPoint may be a mixed blessing. While the software may allow users to communicate information more quickly, it does not necessarily enable them to analyze whether or not the information is accurate, relevant, or current. In this way, PowerPoint presentations are a powerful medium suspected of having a detrimental effect on the construction of meaning. For example, PowerPoint presentations can encourage passivity in student learning, contradicting the *active learning* models favored in modern classrooms. In such an environment, students become "compulsive information consumers" who favor passive reception of information over the more challenging act of thinking (Morrisett, 1996).

PowerPoint Misuse and Misconceptions

This misuse of technology in higher education has raised a growing global concerns and an emergent need for technological reform. In particular, the misuse of PowerPoint has been specifically identified as a salient example of a failed technological innovation requiring understanding and management. The longer this misuse remains unchallenged, the more likely the misuse and any associated misconceptions will become firmly established. Most students rely on PowerPoint when assigned a presentation, whether or not they are specifically asked to use it. Thus, for most, the term *presentation*

has become synonymous with the use of PowerPoint. Misuse is an integral component of misconception, and plays a vital role in an individual's mental model. Such misconceptions help explain knowledge gaps, as well as why and how people communicate some information and not others.

The above-mentioned maladaptive PowerPoint practices are heavily influenced by inaccurate prior knowledge and beliefs obtained through experience and instruction. For example, college students' overuse of PowerPoint presentations could be connected to instructors' overuse of PowerPoint, instructors' beliefs, and by the explicit or implicit message students receive about the appropriateness or compatibility of PowerPoint as a presentation style. From a constructivist standpoint, learners accumulate prior beliefs, knowledge, and skills as they observe and unreflectively use PowerPoint as a medium. As the students continue to learn, they construct knowledge about PowerPoint usage, yielding both valid and invalid beliefs. That is, the process of knowledge construction may lead learners to construct representations of the world that are either valid or systematically biased. Therefore, if learners are to be active players in their own knowledge construction, instructors must consider their role as facilitators of that knowledge development. This supports the notion that, while instruction can create misconceptions, it can also resolve them.

Currently, there is little evidence as to whether perceptions or misconceptions of PowerPoint can be successfully altered through user intervention, or whether such change could lead to positive intention. This is currently the case in Saudi Arabia, where this study was conducted. A push for accreditation, e-learning, reform, self-learning, and student-led teaching environments have all significantly increased the use of technology in Saudi Arabia's universities over the past decade. However, teacher education programs in Saudi Arabia provide few opportunities for effective technology integration. Moreover, technology use, particularly the overuse of PowerPoint as a pedagogical tool, has somewhat negatively influenced classroom instruction and learning in Saudi Arabia. With the increase in the number of Saudi graduates and, correspondingly, more Saudis entering the workforce, the appropriate use of PowerPoint as a teaching and learning tool must be addressed.

Research Aims

The overall goal of this research is to examine the nature of conceptual change and dynamic interactions between instructors and learners in order to precipitate a paradigm shift in PowerPoint user beliefs and behaviors. Specifically, this study examines female graduate students at a large university in Saudi Arabia and their misuse of PowerPoint. In a workshop setting, the researcher relies on a constructivist environment to encourage change in participants' unreflective beliefs, misconceptions, and improper PowerPoint use and practices. The research addresses the idea of misconception as a pre-determinant of technological misuse and introduces the concept of *dynamic misconception* as it relates to technological knowledge development and gradual behavioral change. A conceptual change model in the form of a pre- and post-survey is used to measure any shift in belief.

Theoretical Background

Craig and Amernic (2006) advise that PowerPoint users should continuously reflect on any new technology and how it unintentionally affects their engagement with what and how they present. "We should be eager to understand the assumptions and metaphors that subtly infuse PowerPoint" (p. 158). Such an understanding involves examining the nature of current misconceptions about PowerPoint presentations. Theories from the fields of developmental psychology, education science, information technology, and conceptual development can help provide an understanding of the role of misconceptions as an antecedent of technology behavior, while conceptual change theory can help address misconceptions as a barrier to understanding technological tools such as PowerPoint.

Information Technology and the Technology Acceptance Model

Many Information Technology (IT) and Information Systems (IS) approaches are an extension of Rogers' (1983) Diffusion of Innovation (DOI) perspective in that they cite a comprehensive set of beliefs as determinant factors of IT adoption and usage, such as: individual user characteristics (Brancheau & Wetherbe, 1990), information foundation and communication tools (Nilikanta & Scammell, 1990), and innovation characteristics (Moore & Benbasat, 1993). DOI theory views innovation as being communicated through certain channels over time and within a particular social system (Rogers, 1995). Individuals are seen as possessing different degrees of willingness to adopt innovations; thus, it is generally observed that innovation adoption is virtually normally distributed across a population over time (Rogers, 1995).

Davis (1989) explains IT usage behavior using his Technology Acceptance Model (TAM), where technology acceptance that is focused on behavioral intention and its antecedents leads to usage of new technology and, consequently, implementation success. The TAM was built upon DOI theory, and has demonstrated good predictive validity for both initial adoption and continued use of various IT

(Szajna, 1996). Moore and Benbasat (1991) refined Roger's (1983) theoretical and operational definition of innovation beliefs into seven conceptually distinct constructs to measuring the adoption of IT. Among the seven constructs later examined by Moore and Benbasat (1996) to predict technology usage, three were significantly related to usage: *perceived ease of use, perceived usefulness, and compatibility*. Similar empirical IT studies (Karahanna, Straub, & Chervany, 1999; Taylor & Todd, 1995) have supported research on the importance of compatibility in predicting technology acceptance.

In comparing the TAM to DOI, it is evident that the former is related to cognition, while the latter is based on environmental and social behaviors (Sutton, 2002). Aside from the assumed mediating effect of these two variables on environmental and personal influence on behavior, neither approach directly addresses pre-antecedent variables, such as the attachment to prior inaccurate beliefs and related practices. Both approaches, however, rely on the assumption that the stronger the intention toward the planned behavior, the greater the possibility of the intended action (Sniehotta, 2009). However, Ajzen's (1991) theory of planned behavior (TPB), a foundation of the TAM, has received both conceptual (Ogden, 2003) and empirical criticism (Sutton, 2002). Among many others, Sniehotta (2009) discussed these criticisms from the perspective of self-regulatory theory, which argues that people must incorporate active plans in order to translate their intentions to behavior. In this respect, the journey from intention to action with regard to IT adoption and innovation can be hindered or prevented by improper beliefs and misconceptions.

Technology usage and innovation have historically been plagued by failures, of which user resistance has consistently been recognized as a salient cause. In response to technological changes, users may resist new approaches (e.g., alternative presentation styles) and demonstrate low behavioral intention due to attachments to preexisting opposing beliefs and misconceptions, or positive inclination toward the status quo.

Previously addressed IT theories, based on social constructivist views, provide preliminary evidence that adoption and usage of IT innovations are determined by personal beliefs and attitudes (Taylor & Todd 1995; Venkatesh & Davis, 2000), and that they tend to change over time as users encounter new information that collide with opposing beliefs. Such beliefs and misconceptions can be addressed by conceptual change theories. Thus, in understanding and accounting for misconceptions in IT usage and innovation behavior, conceptual change theory, in conjunction with the TAM, provides a valuable framework for unveiling the complexities of IT behavioral change.

Conceptual Change Theory

The knowledge-as-theory perspective, which dominates the field of conceptual change (Posner et al., 1982), relies on Kuhn's notion of a paradigm shift and Piaget's idea of accommodation. Knowledge-as-theory happens when naïve (initial) knowledge is organized into a coherent theory, thereby providing a schema that has explanatory power to consistently interpret situations across multiple contexts and domains (Ozdemir & Clarke, 2007).

Piaget's (1985) notion of assimilation and accommodation argues that conflicting examples influence learners in one of two ways: 1) they convince the learner to ignore, dismiss, or reinterpret new information by assimilating it into the existing framework, or 2) influence the learner to replace the existing conceptual framework, along with any associated misconceptions, with scientifically appropriate alternatives. Accordingly, misconceptions are not only inaccurate beliefs irrelevant to and independent from the learners' conceptual ecology, but are also attached to other concepts within the learner's broad conceptual ecology (Ozdemir & Clark, 2007).

Carey (1999) and Chi (1992) embrace an ontological conceptual shift, proposing that a revolutionary change in naïve knowledge structure is expected. In other words, correcting a misconception is not a simple process, as it requires the alteration of the entire mental framework in its ecological sense. Such an expectation involves the introduction of cognitive conflict (Posner et al., 1982); for successful conceptual change, the learner must become dissatisfied with his or her existing initial, naïve conception in order to abandon it for a new conception. This process of replacement is essentially defined as holistic and dramatic, although many theorists acknowledge that it is also time-consuming and lengthy (Ozdemir & Clark, 2007).

Dynamic vs. Static Misconception

Defining the notion of a concept itself has occupied philosophers, psychologists, cognitive scientists, and educationists over several decades, during which various approaches to substantiating a concept have emerged. Traditionally viewed as concrete objects that are as static and isolated as "tables" and "chairs," a concept is now assumed to have both perceptive and conceptual attributes that belong to the same hierarchical category. Current literature portrays a concept as subjective to experience and use. This new approach advocates for dynamic concepts (Medin & Rips, 2005), such as the "effective presentation," which involves interrelated

ideas and suggests a more active acquisition or achievement by the learner.

Broadening the boundary of scientists' and psychologists' concrete or static concept might be the foundation of Chi's (2008) interpretation of misconception. Chi states that the grain size of prior conflicting ideas (i.e., "misconceptions") does not have to be identical to that of the traditional concept. According to Chi (2008), misconception can occur at any of the three different levels (grain sizes) of knowledge representation: individual belief, mental models, and ontological categories. Misconception at the individual belief level is represented as static misconception. Thus, misconception at the mental model and ontological category levels might be represented as *dynamic*: that is, misconception beyond the individual level involves the misconceptualization of dynamic concepts.

Besides the complex nature of misconceptions, recognizing the sources of misconception is critical to promoting conceptual change in IT behavior. Misconception can arise internally (from individual mental activity) or externally (as a result of daily life experiences) (Taber, 2004). The National Research Council (1997) offers strategies to classify misconceptions [i] and to identify external sources of misconception emerging from everyday experiences, religion, and educational settings. Being aware of the origins of misconception not only enriches our understanding of it, but also guides conceptual change efforts toward *where* and *how to* correct misconceptions relative to IT constructs.

Conceptual Change Strategies

Opposing views of how people resolve their misconceptions have profound implications for the current research concerning pedagogical strategies and training techniques. If understanding is dominated by a holistic conceptual structure, even if the learner possess a naïve knowledge framework, they will become dissatisfied with existing concepts when conflicting examples are introduced (Posner et al., 1982). On the other hand, if a learner's initial knowledge consists of loosely connected elements, then, according to Ozdemir and Clark (2007), instruction should focus on activating these elements by confronting learners with the same phenomena in different contexts, focusing on continuous refinement through adding, modifying, eliminating, and organizing knowledge within the learner's overarching knowledge structure.

Further, the number of correct beliefs held by the learner is irrelevant to the process of transitioning from a flawed model to a correct one (Chi, 2009). This demonstrates that, regardless of the quantity of a learner's faulty mental models, misconceptions can be resolved through conceptual change strategies, such as those suggested by the National Research Council (1997) and Gooding and Metz (2011). [ii] While misconceptions can be managed in a social setting, understanding learners craft their theories of reality on an individual basis requires misconceptions to be similarly corrected by the individual (Gooding & Metz, 2011).

Although IT learners may positively regard IT communication, the literature shows evidence of low awareness and education with regard to what, why, and how to properly use IT communication in professional situations. Common IT communications tend to be spontaneous and not well planned or objectively guided. For example, it is common practice for college graduates to communicate or relay messages through several overlapping text chat windows. While there are studies on IT behavior, concept formation, and conceptual change, no studies have examined PowerPoint misconceptions in training courses. Moreover, outside of the IT field, little research addresses or measures the effectiveness of PowerPoint training courses, particularly from a conceptual change standpoint.

Conceptual Change Strategies for Dynamic Misconception

Since the interconnectedness of cognitive structure in relation to PowerPoint conceptualization and practice is invisible and tied to each learner's individual background and experience, this study addresses two opposing views of how learners change their misconceptions. First, *dynamic misconception* is addressed through holistic confrontation, which involves examining and contrasting the flawed mental model with the correct model in terms of each model's predictions, explanations, and elements. Second, *dynamic misconception*, regardless of the intensity of connections between related concepts or ideas in the trainee's cognitive structure, can be changed through piecemeal instruction. Each instructional component directly or indirectly refutes an existing idea. When confronting a learner's dynamic misconception through holistic or grain-sized conceptual change, one of two possible scenarios may results: 1) the new idea is not refuted, therefore reinforcing the existing incorrect mental model, or 2) the existing false belief is refuted because the perceived contradiction led to a revised belief (Chi, 2009).

For example, a teacher may explain that human interaction constitutes 90% of communication. In the first scenario, if this information does not directly contradict the learner's prior knowledge, that prior knowledge would not be refuted. Instead, the learner might assimilate and embed this new information into the existing flawed mental model, which might contain the idea that "PowerPoint is the most appropriate presentation tool." From the learner's

perspective, the mental model is then enriched, but from the expert's perspective, the model continues to be flawed. To avoid this pitfall, conceptual change strategies are used to elicit the learner's schematic interpretation of current beliefs, thoughts, and information.

In the second scenario, the presented information might refute existing false beliefs because of the perceived contradiction between the two, thereby causing conceptual change. For example, knowing that human communication, both verbal and nonverbal, constitutes 90% of communication implies that the remaining 10% comprises all non-human communication, as with the use of PowerPoint. Thus, a learner who initially believes that PowerPoint is the most appropriate presentation tool, and then learns that human interaction is 90% communication, may revise their existing misconception, especially if this new information is presented in a way that activates the affective and cognitive dimensions of learning. It is through the learner's recognition of the contradiction between false beliefs ingrained in the existing mental model and the correct, scientific model that conceptual change occurs. However, conceptual change is not guaranteed, as many factors can affect its success; among these, this research analyzes the complexity of the measured false beliefs that constitute or shape a mental model.

PowerPoint misconceptions are expressed at several levels of complexity depending on prior knowledge and experience of that particular domain. For example, believing that effective PowerPoint slides are equivalent to an effective PowerPoint presentation is a misconception of conceptual properties. Essentially, when a single prior incorrect idea (e.g., PowerPoint slides are equivalent to a PowerPoint presentation) conflicts with ideas that have not yet been learned (e.g., PowerPoint slides are not necessarily equivalent to a PowerPoint presentation), it becomes a static misconception. Thus, if misconceptions stem from conflict between old and new information, conceptual change instruction should correct prior knowledge through idea revision (Chi, 2008). However, many misconceptions, especially as related to PowerPoint practices, might not be so readily revised by refuting a single idea. Rather, they would require conceptual change at an ecological (that is, a holistic, interactional) level, along with correction of the associated dynamic and interrelated misconceptions.

Consider the belief that "using various colors in PowerPoint slides helps the audience pay attention to the presentation's message." Although students may readily acquire new information that modifies their understanding of this misconception—definition of attractiveness, audience role, color theory, and so on—this new information might not correct their misconception about the effectiveness of the use of colors in PowerPoint itself. Moreover, such false beliefs cannot be easily denied or corrected by contradiction. Thus, simply stating that employing color variation does *not* improve presentation effectiveness will not help precipitate conceptual change. Rather, facilitating understanding requires a dynamic and ecological consideration of inter- and intra-dependent situational factors and conceptual change. In considering the previous example, we can see that prior or incorrect information and new or correct knowledge do not always directly contradict, as explained by Chi (2009). Misconception at such a level could thus be labeled *dynamic misconception*.

Dynamic misconception is a particularly appropriate descriptor of misconceptions related to a specific knowledge domain (e.g., PowerPoint presentations) that is experienced or taught in educational institutions. Moreover, understanding what has been misconceived in relation to the grain-sized knowledge imparted helps define the level of conceptual change at which instruction should be given (Chi, 2008).

2. Material and Methods

PowerPoint is still heavily used as a business communication tool, and college graduates are expected to be able to use it effectively. Based on this background, this experimental study employed conceptual change intervention strategies to consider the idea of *dynamic misconception* for the purpose of encouraging change and discouraging improper use of PowerPoint presentations. To accomplish this, this study attempts to transform a flawed mental model by refuting false beliefs through self-explanatory instruction, group interaction, and interactive conceptual change models in a PowerPoint workshop.

Workshop Design

To analyze the aforementioned objectives, a nine-hour PowerPoint workshop was conducted over the course of three days through the Center of Teaching and Learning Development (CTLD) at King Abdulaziz University in Saudi Arabia. The workshop was designed to uncover and address users' dynamic misconceptions and facilitate specific methods to encourage change in misconceptions about and misuse of PowerPoint presentations. To accomplish this, the previously discussed conceptual change strategies for dynamic misconception, along with the National Research Council's (1997) and Gooding and Metz's (2011) suggested strategies, were adapted for the workshop design.

Participants

This study was conducted to 20 female native Saudi graduate students from King Abdulaziz

University. Participants ranged in age from 24 to 35 years old. Of the original 20 participants, 65% (N = 13) consented to participate in the workshop and completed pre- and post-workshop surveys. Along with their primary language (Arabic), participants shared similar ethnographic and educational backgrounds, with 80% studying a science. All had some experience using MS PowerPoint presentations. All participants were CTLD members and received a certificate from the center for participating in the workshop

Survey Instrument

An 18-item pre- and post-workshop survey instrument was developed to collect participants' thoughts and conceptualize their beliefs regarding PowerPoint (Appendix A). The instrument used a five-point Likert scale, where 1 = strongly agree and 5 = strongly disagree, and contained three subscales: presenter benefit, audience benefit, and PowerPoint software benefit. These two scales were integrated to measure a gradual shift from old, tentative theories to more scientifically valid theories. Influenced by Popper's (1972) view of the importance of maintaining a tentative attitude toward one's own theories (as these are subject to change), each new perspective or belief identified in the pre-workshop survey could potentially become a new starting point for further change. Instead of asking a true/false questions (Newens et al., 1996) or multiple choice questions (Krause, et al., 2010) to monitor conceptual change, this study's misconception instrument acknowledges the importance of affective domain in the conceptual change process (Gregoire, 2003) by eliciting learners' responses to each statement. The instrument was designed to be used before and after the workshop in order to uncover dynamic misconceptions about PowerPoint, and to measure any shift in belief.

Instrument Reliability and Validity

Efforts were made to ensure that the instrument was valid and that items were clear and relevant to participants' learning experiences. Before the study, the instrument was administered to 165 randomly selected female graduate students from King Abdulaziz University. The constancy of the instrument compared to the test length (split-half reliability) was determined using Spearman Brown's correlation. Cronbach's alpha was also used to evaluate the instrument's self-consistency and homogeneity. The survey was then administered to 13 Saudi Arabian female graduate students to determine general dynamic misconceptions of PowerPoint as a visual aid, as well as to measure behavioral change as a direct result of workshop intervention strategies. Prior studies on conceptual change and information technology research were also analyzed to identify the underlying faulty beliefs (referred to in this paper as *dynamic misconceptions*) that drive misconceived or problematic PowerPoint presentation practices.

Workshop Procedure

To ensure successful integration of conceptual change approaches and pedagogical strategies, namely knowledge-building process (Oshima & Scardamalia, 1996), the researcher prepared and facilitated the workshop with four training assistants (two graduate students and two CTLD staff members) who were already engaged in the process of helping learners build their knowledge. Along with multimedia, the following materials were used:

- Survey instrument (pre- and post-workshop)
- Ice-breaker games and 3x5 cards containing PowerPoint statistics
- Printed handbook (guidelines, multimedia principles, PowerPoint concepts, learning theories, daily schedule, worksheets, references, etc.)
- Participants' previous presentations and instructional PowerPoint presentations
- Blank flip chart for note-taking during the workshop
- Supplies for interactive activities (songs, adhesive notes, colored markers, string, plastic educational ball, plastic container of water, seasoning pepper)
- Self-report evaluations provided by the CTLD

The facilitator's process was as follows:

1. Introduced two co-trainers and two CTLD staff members
2. Shared the workshop's goals, expectations, scope, and timeline using written guidelines, requirements, and handbook containing worksheets and other related materials and tools
3. Presented the workshop's main issue and shared facts and statistics about PowerPoint users using icebreakers
4. Administered the survey instrument
5. Presented mini-lectures on the following subjects:

a. Challenges of PowerPoint presentations regarding existing slide design and content; unexpected presentation practices (in order to create cognitive dissonance)

b. Research results, statistics, anecdotes, and business and education sector comments that support the existence of the aforementioned presentation delivery challenges

c. Sound multimedia principles, including good and bad examples

d. Appealing PowerPoint presentations that take an "assertive evidence" approach

6. Facilitated the following peer activities to encourage interaction, thoughts about conceptual change, and reflection:

a. Individually redesign an old PowerPoint presentation

b. Share and evaluate the presentation in small peer groups

c. Present and discuss PowerPoint presentation comments with the rest of the workshop

d. Engage in reinforcement activity (e.g., discuss and determine how to throw a lamp without breaking it)

e. Engage in reflective string activity (e.g., "What will you take with you?")

7. Re-administered the survey and discussed the survey statements using PowerPoint slides

8. Summarized the workshop to verify participant understanding ("What did we learn?")

9. Distributed the Center's evaluation

3. Results

Preliminary statistical tests from the pilot study were used to run principle factor analyses, including the Determinant, the Kaisar-Meyer-Olkin (KMO) measure of sampling adequacy, and Bartlett's test. Responses were subjected to principle factor analysis with a varimax rotation in order to construct a structure of PowerPoint beliefs and validate the hypothesized structure of PowerPoint misconceptions. Additionally, an explanatory factor analysis was undertaken in order to summarize the features of the relationships between items and to define the reasonable basic structure of the instrument. The results and analysis below are described in terms of instrument validity and reliability (as determined in the pilot study) and conceptual change (relative to the experimental study). Statistical results are described below and provided in detail in Appendix B.

Survey Instrument

The reliability test for the survey instrument (N = 165) yielded the accepted measure (0.729) using split-half techniques and Cronbach's alpha (0.809). The validity was measured using Spearman-Brown's (0.74), and Getman's (0.737) correlations. For internal validity (illustrated in Table B.1), the Pearson linear correlation coefficient between individual items and the constructs was moderately high: only one out of 18 multiple correlations was below 40, indicating that, in general, the items shared substantial variance with their hypothesized constructs.

Along with the study hypothesis, principle factor analyses determined belief structure and delineated features of the relationships between instrument items. A preliminary statistical test of principle factor analyses for the instrument yielded the determinant $(0.007) \neq Ø$, with a KMO measure of $(0.772) > 0.5$, and a Bartlett's test result of $(0.00) > 0.05$.

Following analysis of the survey's factor structure, 18 items were placed into factors where they would have the highest value (illustrated in Table B.2). Principle factor analysis indicated significant loading for items on the hypothesized construct ($P < 0.05$ in all cases). In addition, there was little variance in the λ values within each construct, indicating that the items tended to contribute equally to the formation of the construct. This specific analysis yielded a six-factor solution with Eigen values greater than 1 in the un-rotated matrix. However, when the principal component factor analysis was repeated with the varimax rotation method by Kaiser normalization, the rotation was converted into 12 iterations in order to elicit the concordance of the scale constructs.

The first three factors (13 items) obtained from the scale explain 41% of the total variance (illustrated in Table B.3). Factor I, which contains six items, explains 25.5% of the total variance. Factor II, which consists of three items, explains 8.75% of the variance. Factor III, which contains four items, explains 6.8% of the variance.

Due to partial discrepancies between items that correspond to theoretical domains and statistical factors, items with both theoretical and empirical support (10 of the first three factors) formed what the researcher calls the three congruent factors, highlighted in the subsequent analysis of the experimental study (illustrated in Table B.4). The three subscales from the survey instrument were used.

Three out of the six items belonging to Factor I, (items 5, 7, and 8) were congruent with the theorized "presenter benefit" subscale. Three out of the five items belonging to Factor II (items 2, 6, and 9) were congruent with the theorized "audience benefit" subscale. Four out of the seven items belonging to Factor III (items 3, 15, 16, and 18) were congruent with the theorized "overall benefit" subscale.

In addition to principle factor analysis, structural validity was also measured between each individual subscale and the construct, yielding values of 0.711, 0.799, and 0.927 ($P < 0.01$) for the first three factors, respectively, indicating construct validity, particularly of the first three sub-constructs.

A descriptive statistical analysis of the experimental study (N = 13) and the pilot study (N = 165) (as illustrated in Table B.5) shows that the experimental study's overall mean pre-score was significantly similar to the pilot study. It is also clear here that the overall mean score of post-workshop misconceptions is significantly higher than the pre-workshop score. Overall, out of the 18 identified dynamic misconceptions, 11 demonstrated significant positive change according to the post-workshop

measure. However, only seven of the 11 misconceptions (items 2, 5, 6, 7, 9, 15, and 16) were theoretically and empirically supported, representing 70% of the congruent factors.

Finally, the pilot revealed significant differences between the pre- and post-workshop subscales (congruent factors) (Appendix B, Table 6), illustrating that participants' misconceptions regarding "presenter benefit" were significantly changed or corrected.

4. Discussions

Given the low frequency of the effective use of PowerPoint presentations, this research carries important implications for IT trainers and researchers. Specifically, integrating conceptual change, the idea of *dynamic misconception*, and technology behavior yielded five key benefits. First, if IT adoption and usage models consider misconception as an additional pre-determinant, these models might explain maladaptive IT behavior and, in turn, be modified to help effectively implement new technology training. Second, the inclusion of dynamic misconception in IT adoption and usage models can enhance understanding of the establishment and correction of misconceptions, enabling practitioners to more clearly grasp what factors influence resistance to behavioral change. Third, understanding how dynamic misconception influences individuals to change their IT behavior may increase the possibility of successful conceptual change. Focusing on a conceptual change approach via dynamic misconception strategies may supplant traditional pedagogical strategies, such as "skill building" (Selber, 1994; Hopper & Rainey, 2003), that lead to increased computer and PowerPoint misuse in educational settings. A fourth, practical implication for PowerPoint presentation trainers is to highlight and modify PowerPoint presenters' common misconceptions in relation to current practices. Even though *perceived usefulness* is one of the three significant factors that predicts technology usage (Moore & Benbasat, 1996), usefulness in this context relates to new/desired IT behavior, rather than to users' beliefs about the benefits of current IT behavior. The above implications, which entail increased efficiency, attainment of training goals, better communication between presenters and audiences, and improved PowerPoint presentation practices, reflect the positive outcomes of this study. Of these, the greatest implication for practitioners and trainers is the general recognition of misconception as a pre-determinant of IT adoption and usage, the correction of which can facilitate successful IT behavior in educational organizations.

Conclusion

The primary goal of this research was to effect change in users' PowerPoint-related beliefs and behavior. Specifically, this research addressed PowerPoint users' behavior resulting from misconceptions developed through prior knowledge and teaching practices. To accomplish this, the study introduced the idea of *dynamic misconception*, and conducted a workshop to implement conceptual change strategies to resolve these misconceptions. Secondary outcomes were recorded through participants' oral reflection, perceived behavioral change, perceived intentional change, and willingness to change others' perceptions and behaviors. Analysis revealed that conceptual change strategies could dispel myths, change dynamic misconceptions, and promote positive behavioral change in PowerPoint users.

This study confirms that facilitating conceptual change requires modifying the knowledge-building process, understanding how to rationalize and evaluate old perspectives and beliefs, and applying these changes across IT education. Moreover, integrating the notion of *dynamic misconception* into IT adoption and usage models allows researchers to investigate various iterations of how *dynamic misconception* or its absence may affect the acceptance and usage of new IT methods.

Limitations

The research was limited to 13 graduate female students, who voluntarily registered for the workshop and shared their beliefs about the use of PowerPoint presentations. These participants would likely have registered for any training course offered by the CTLD at King Abdulaziz University. As such, the quality of the design and the participants' intention to adopt new technology may differ from that of male students or those with different PowerPoint experiences. Additionally, the study's results were restricted to a closed Likert scale, which cannot offer as holistic a view of PowerPoint beliefs as would open surveys or interviews.

Further Research and Recommendations

Further research could examine the content validity of a PowerPoint presentation survey by rearticulating the role of *dynamic misconception* in presentation behavior, conducting follow-up studies to further explore conceptual change, and possibly by gauging alteration in dynamic misconception. Additionally, more methodologically sound interventions are needed to correct PowerPoint presentation misconceptions, which may in turn promote a change in overall IT behavior. This research may also help instructors reevaluate traditional PowerPoint training techniques and consider conceptual change strategies that encourage users to challenge their assumptions and self-correct

ineffective behaviors. Finally, PowerPoint beliefs discussed in this research were related to presenter, audience, and software benefits. Future PowerPoint training courses might focus on dynamic misconceptions related to users' perceived benefits. Such a favorable shift in trainee beliefs could lead to improvements in effort, planning, and professional development.

Acknowledgements:

The author would like to express the deepest appreciation to Lynn Lundy Evans as well as the Center of Teaching and Learning Development at King Abdulaziz University for their helpful contributions to this manuscript.

Corresponding Author:
Dr. Enas O. SArour
Department of Family Sciences
King Abdulaziz University
P.O. Box 645 Jeddah 21421, Saudi Arabia
Email: isoroor@kau.edu.sa

References

1. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50* (2), 179–211.
2. Alfahad, F. N. (2012). Effectiveness of using information technology in higher education in Saudi Arabia. *Social and Behavioral Sciences, 8*, 1268–1278.
3. Brancheau, J. C., & Wetherbe, J. C. (1990). The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-user Computing. *Information Systems Research, 1* (2), 115–143.
4. Carey, S. (1999). Sources of conceptual change. In E. K. Scholnick, K. Nelson, & P. Miller (Eds.), *Conceptual development: Piaget's Legacy* (pp. 293–326). Mahwah: Lawrence Erlbaum Associates.
5. Chi, M. T. (1992). Conceptual change within and across ontological categories: Examples from learning and discovery in science. In R. N. Giere (Ed.), *Cognitive Models of Science: Minnesota Studies in the Philosophy of Science* (pp. 129–186). Minneapolis: University of Minnesota Press.
6. Chi, M. T. (2008). Three types of conceptual change: Belief revision, mental model transformation, and categorical shift. In S. Vosniadou (Ed.), *Handbook of Research on Conceptual Change* (pp. 61–82). Hillsdale, NJ: Erlbaum.
7. Chi, M. T. (2009). Active-Constructive-Interactive: A conceptual framework for differentiating learning activities. *Topics in Cognitive Science, 1*, 73–105.
8. Craig, R. J., & Amernic, J. H. (2006). PowerPoint presentation technology and the dynamics of teaching. *Innovative Higher Education, 31*, 147–160.
9. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–339.
10. Gooding, J., & Metz, W. (2011). From misconception to conceptual change. *Science Teacher, 78* (4), 34–37.
11. Gregoire, M. (2003). Is it a challenge or a threat? A dual-process model of teachers' cognition and appraisal processes during conceptual change. *Educational Psychology Review, 15*, 147–179.
12. Hopper, K. B., & Rainey, K. T. (2003). A pilot study of self-assessment of word processing and presentation software skills in graduate students in technical communication. *IPCC 2003 Proceedings: The Shape of Knowledge* (pp. 242–249). Orlando, FL: IEEE International Professional Communication Conference.
13. Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: a cross-sectional comparison. *MIS Quarterly, 23* (2), 183–213.
14. Krause, S., Kelly, J., Tasooji, A., Corkins, J., Baker, D., & Purzer, S. (2010). Effect of pedagogy on conceptual change in an introductory materials science course. *International Journal of Engineering Education, 26* (4), 869–879.
15. Medin, D. L., & Rips, L. J. (2005). Concepts and categories: Memory, meaning, and metaphysics. In K. J. Holyoak, & R. G. Morrison (Eds.), *The Cambridge Handbook of Thinking and Reasoning* (pp. 37–72). New York: Cambridge University Press.
16. Moore, G. C., & Benbasat, I. (1991). The development of an instrument to measure the perceived characteristics of adopting an information technology innovation. *Information Systems Research, 2* (3), 192–222.
17. Moore, G. C., & Benbasat, I. (1993). An empirical examination of a model of the factors affecting utilization of information technology by end-users. *Working paper, University of British Columbia, Faculty of Commerce*.
18. Moore, G. C., & Benbasat, I. (1996). Integrating diffusion of innovations and theory of reasoned action models to predict utilization of information technology by end-users. In K. Kautz, & J. Pries-Heje (Eds.), *Diffusion and Adoption of Information Technology* (pp. 132–146). London: Chapman and Hall.
19. Morrisett, L. (1996). Habits of mind and a new technology of freedom. *First Monday, 1*(3).
20. National Research Council. (1997). *Science Teaching Reconsidered: A Handbook.* Washington, D.C: The National Academies Press.
21. Newens, A. J., McColl, E., Bond, S., & Priest, J. F. (1996). Patients' and nurses' knowledge of cardiac-related symptoms and cardiac misconceptions. Heart Lung. *Heart Lung, 25* (3), 190–199.
22. Nilikanta, S., & Scammel, R. W. (1990). The effect of information sources and communication channels on the diffusion of innovation in a database development environment. *Management Science, 36* (1), 24–40.
23. Office of Educational Research and Improvement. (1998). *Facing the Challenge of Technology Integration: A Portfolio of Processes: Facilitator's Manual.* Washington, D. C.: U.S. Dept. of Education, Office of Educational Research and Improvement, Educational Resources Information Center.
24. Ogden, J. (2003). Some problems with social cognition models: A pragmatic and conceptual analysis. *Health Psychology, 22* (4), 424–428.
25. Oshima, J., & Scardamalia, M. (1996). Knowledge-building and conceptual change: an inquiry into student-directed construction of scientific explanations. In D. C. Edelson, & E. A. Domeshek (Eds.), *Proceedings of the International Conference on the Learning Sciences* (pp. 256–63). Charlottesville: Association for the Advancement of Computing in Education.
26. Ozdemir, G., & Clark, D. B. (2007). An Overview of Conceptual Change Theories. *Eurasia Journal of*

Mathematics, Science & Technology Education, 3 (4), 351–361.
27. Piaget, J. (1985). *The Equilibration of Cognitive Structures.* Chicago: University of Chicago Press.
28. Popper, K. R. (1972). *Objective Knowledge: An Evolutionary Approach.* Oxford: Clarendon Press.
29. Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education, 66*, 211–227.
30. Prensky, M. (2001). Digital natives, digital immigrants (part 1). *On the Horizon, 9* (5), 1–6.
31. Rogers, E. M. (1995). *Diffusion of Innovations* (4th ed.) New York: The Free Press.
32. Rogers, E. M. (1983). *Diffusion of Innovations* (3rd ed.) New York: The Free Press.
33. Selber, S. A. (1994). Beyond skill building: challenges facing technical communication teachers in the computer age. *Technical Communication Quarterly, 3*, 365–390.
34. Sniehotta, F. F. (2009). Towards a theory of intentional behaviour change: Plans, planning, and self-regulation. *British Journal of Health Psychology, 14*, 261–273.
35. Sutton, S. (2002). Testing attitude-behaviour theories using non-experimental data: An examination of some hidden assumptions. *European Review of Social Psychology, 13* (1), 293–323.
36. Szajna, B. (1996). Empirical evaluation of the revised technology acceptance model. *Management Science, 42* (1), 85–92.
37. Taber, K. S. (2004). Learning quanta: barriers to stimulating transitions in student understanding of orbital ideas. *Science Education, 89*, 94–116.
38. Taylor, S., & Todd, P. A. (1995). Understanding information technology use: A test of competing models. *Information Systems Research, 6* (2), 144–176.
39. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science, 46* (2), 186–204.

Appendix A

Survey Instrument (Pre- and Post-)

Name (optional): …… Code: …….

Please express your agreement with the following statements by placing a (√) in the appropriate place.

	Statements	Strongly Agree 1	Agree 2	Some-what agree 3	Do Not Agree 4	Strongly Disagree 5
1	The on-screen text helps the presenter explain the topic.					
2	The variety of colors in the slides draws the audience's attention.					
3	PowerPoint presentations can cover all dimensions of the presented topic.					
4	The widespread usage of PowerPoint indicates its appropriateness as a presentation tool.					
5	PowerPoint presentations help the presenter memorize the information to be presented.					
6	Using animation in PowerPoint slides helps the audience to focus on the content (the essence of the presentation).					
7	Well-constructed PowerPoint slides guarantee good presentation.					
8	PowerPoint presentations reflect the presenter's prestige and professionalism.					
9	Slides, pictures, and decorative elements engage the audience.					
10	PowerPoint presentations help present long and complicated topics.					
11	I believe research advocates the use of PowerPoint to facilitate effective learning.					
12	When used more than once, PowerPoint presentations conserve the presenter's time and effort.					
13	Using bullet points in slides helps the audience understand complicated topics.					
14	Audience retention rates increase by using PowerPoint presentations.					
15	PowerPoint's various functions (options) deter the presenter from using other activities.					
16	PowerPoint is more helpful for conveying presentation messages than other presentation tools.					
17	PowerPoint's various functions (options) accelerate the slide design process.					
18	Using a very large font size negatively affects the slide design.					

Appendix B
Pilot Study

Table B.1 Correlation between Individual Items (Internal validity)

Item #	Pearson's linear correlation	Item #	Pearson's linear correlation	Item #	Pearson's linear correlation	Item #	Pearson's linear correlation
1	0.413*	6	0.727*	11	0.658*	16	0.664*
2	0.657*	7	0.588*	12	0.592*	17	0.466*
3	0.644*	8	0.637*	13	0.537*	18	0.382*
4	0.637*	9	0.636*	14	0.617*		
5	0.686*	10	0.558*	15	0.613*		

0.05* sig. at

Table B.2 Rotated Component Matrix (a) of Misconception Factor Structure

Item #	**Component**					
	1	**2**	**3**	**4**	**5**	**6**
7	.787					
5	.693					
4	.611					
8	.584					
14	.532					
11	.459					
2		.795				
6		.752				
9		.650				
15			.720			
16			.635			
18			.611			
3	.391		.418			
12				.733		
13				.685		
17				.640		
10					.621	
1						.836
Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalization.						
Rotation converged in 12 iterations.						

* sig. at 0.05

Table B.3 Total Variance of Six Misconception Factors

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.846	25.506	25.506	4.846	25.506	25.506	2.706	14.242	14.242
2	1.662	8.746	34.252	1.662	8.746	34.252	2.083	10.965	25.207
3	1.293	6.804	41.056	1.293	6.804	41.056	2.027	10.669	35.876
4	1.246	6.556	47.612	1.246	6.556	47.612	1.978	10.411	46.287
5	1.198	6.304	53.917	1.198	6.304	53.917	1.311	6.898	53.185
6	1.067	5.616	59.533	1.067	5.616	59.533	1.206	6.348	59.533
Extraction method: principal component analysis.									

Table B.4 Shared Items between Theoretical Domains and Statistical Factors

Theoretical Domains	Item #	Statistical Factors and Item #	Congruent Factors: Theoretically and Empirically Supported Items
Presenter Benefit	1, 5, 7, 8, 12, 17	F1: 4, 5, 7, 8, 11, 14	5, 7, 8
Audience Benefit	2, 6, 9, 13, 14	F2: 2, 6, 9	2, 6, 9
PowerPoint Software Benefits	3, 4, 10, 11, 15, 16, 18	F3: 3, 15, 16, 18	3, 15, 16, 18
		F4: 12, 13, 17	
		F5: 10	
		F6: 1	

Table B.5 Descriptive Analysis of Misconceptions in Pilot and Experimental Studies

Pilot study (N = 165)			Experimental study (N = 13)	
Item #	SD	Mean	Pre-workshop	Post-workshop
			Mean	Mean
1	.687	1.39	1.92	2.5385
2	1.04757	2.0121	2.1538	3.7692*
3	1.07762	2.4303	1.7692	2.9231
4	.92322	1.9636	1.5385	3.0769*
5	.75495	1.5244	1.3846	2.7692*
6	.91965	1.7758	2.3077	3.1538*
7	.56216	1.3171	1.1538	1.6154*
8	.91513	1.7607	1.5385	1.5385
9	.85700	1.6303	1.6154	3.0000*
10	1.06687	2.3333	2.1538	3.1538*
11	.84606	2.0606	1.6154	2.2308
12	.96655	1.8485	1.9231	1.9231
13	1.04498	1.8210	1.4615	3.3846*
14	.86641	1.9509	1.6923	2.3846
15	1.13133	3.0242	2.8462	3.8462*
16	.96712	2.3939	2.0769	3.0769*
17	.81702	1.9146	1.6923	2.9231*
18	1.18200	2.5273	2.6154	2.6154
	8.48	**35.652**	**33.46* (SD 7.677)**	**49.92* (SD 10.579)**

* sig. at 0.05

Table B.6 Misconception Subscale Differences before and after Workshop

Congruent Factors (Subscales)	Measurement Period	Mean	SD	t	Sig.
Presenter Benefit	Pre Post	7.92 10.38	2.253 2.599	2.770-	.017*
Audience Benefit	Pre Post	9.85 15.38	2.824 3.885	4.082-	.002*
PowerPoint software benefits	Pre Post	17.77 27.23	4.833 6.623	4.711-	.001*
Total	Pre Post	33.46 49.92	7.677 10.579	4.750-	.000*

0.05* sig. at

[i] National Research Council (1997):

1. Foreseeing the most critical misconceptions and being attentive to others
2. Facilitating a learning environment where students' cognitive structures can be tested
3. Addressing common misconceptions with hands-on activities and demonstrations
4. Re-examining common misconceptions throughout the learning process
5. Evaluating and reevaluating the validity of developing concepts

[ii] Gooding and Metz (2011, p. 36):

1. Asking students for advance explanation, rephrasing, illustration, or demonstration,
2. Requesting students validate their claims and providing a safe environment for presenting and defending their decisions,
3. Inviting the students to contemplate beyond the collected information,
4. Applying nonverbal strategies to encourage students to clarify their responses and engage in peer discussion, and
5. Encouraging alternative solutions and procedures by avoiding the requirement of the "right answer."

5/23/2014