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ABSTRACT

The goal of situated learning is to promote the use of knowledge in real-life. Because knowledge is inseparable from context, situated learning emphasizes the use of authentic situations as learning environments. To promote the use of knowledge in different situations, transfer should be the main consideration because the same knowledge appears differently in different situations according to situative perspective. Many studies, however, indicate that transfer is a weakness of situated learning.

Salomon and Perkins (1989) introduced a framework consisting of two different types of transfer employing different transfer mechanisms. Low-road transfer occurs through automatization built from repeated practice, while high-road transfer occurs through deliberate recognition of similarities between a new situation and prior experience. Recognition is accomplished by explicit elicitation of abstraction, that is, abstracting principles from prior situations that can be used in new situations. Based on the framework, situated learning induces low-road transfer at best, but not high-road transfer because the learning model does not provide explicit abstraction practice.

The abstraction process involves decontextualization of situations and representation of what is decontextualized into more general symbolic forms. Analogy is one of the well known strategies to abstract general principles, and many studies using analogy to elicit abstraction show transfer in learners’ performance.

Two factors are known influence effective abstraction practice. The first factor is knowledge about analogues used for eliciting abstraction. Because analogy needs an analogue for comparison with a given situation to elicit abstraction effectively and for use of an analogue, the analogue must be understood first. The second factor that is influential for effective
abstraction practice is the degree of mindfulness for the abstraction process. Mindfulness refers to a state of conscious awareness for exertion of active cognitive activities. The more the abstraction is mindful, the more the activities are generative. However, high-level mindfulness may cause mental exhaustion which may hinder effective and efficient learning achievement.

In this study, the effect of different levels of mindful abstraction activities on two types of transfer and the relation with knowledge about analogues were investigated to promote transfer in situated learning. The results showed that mindful abstraction activities were significantly more effective for high-road transfer when participants practiced with effortful abstraction activities than when they practiced with effortless abstraction activities (H₁₁). However, the mindful abstraction activities did not show a significant difference among the groups in low-road transfer (H₀₂). Knowledge about analogues showed no significant difference between the groups in both high-road transfer (H₀₃) or low-road transfer (H₀₄). No significant interaction was found between levels of mindfulness and level of knowledge about analogues for either high-road transfer (H₀₅) or low-road transfer (H₀₆). Finally low-road transfer and high-road transfer showed a significant positive relationship (H₁₇).

When further analysis took the type of course as the third factor into consideration, the groups from the art course showed low-road transfer significantly greater than the groups from the statistics course (Hₐ₀). But there was no significant difference in high-road transfer for groups from difference courses (H₀₈). There was a significant interaction between level of mindfulness and type of course in low-road transfer (H₁₁ and H₁₁'). The groups from the art course were influenced significantly more than the groups from the statistics course by different levels of mindful abstraction activities in low-road transfer.
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CHAPTER 1
INTRODUCTION

Background

Fundamental Educational Goals and Situated Learning

Knowledge retention and its transfer have been fundamental educational goals (L. W. Anderson & Krathwohl, 2001, 1994; Marini & Genereux, 1995; McKeough et al., 1995) for which educators have proposed many theories for achieving them. Conventional educational systems have taught knowledge that is decontextualized from the situations in which it is used and generalized into more abstract principles, and expected learners to apply the knowledge to any encountered situation. This approach treats “knowledge as an integral, self-sufficient substance” (Brown et al., 1989) and assumes the knowledge, once acquired, is efficiently transferable to different situations. Lave (1985), citing that people learn generalized problem solving skills in everyday cognition and use them in real-life settings, questioned the effective transfer of knowledge acquired in conventional school systems to real-life problem settings. Indeed, the conventional way does not demonstrate as much influence for transfer into real world problems as expected (Detterman, 1993; Haskell, 2001; Hatano & Greeno, 1999; Singley, 1995). As an alternative, situated learning is a suggested approach (Brown et al., 1989) for promoting actual “use” of knowledge.

Brown et al. (1989) claimed that knowledge is bounded to its context in which it is employed, hence knowledge loses its meaning when decontextualized and generalized from situations. In order to actually “use” knowledge in real-life situations, learning should occur in
authentic situations while employing the knowledge to accomplish the goal of the situation (Brown et al., 1989). As one is exposed to many situations and practices knowledge within those situations, one will build implicit understanding of the knowledge and its use, and eventually become an expert in the domain (Brown et al., 1989; Collins et al., 1989). Situated learning is believed to fill the gap between “knowing” and “using” and leads to a meaningful learning experience (Brown et al., 1989).

**Limitation of Situated Learning**

Although the situative perspective pursues “use” of knowledge in authentic situations, it has not successfully shown consistent empirical evidence of transfer. Rather it has been criticized for its transfer weakness (J. R. Anderson et al., 1997; J. R. Anderson et al., 1996; Bereiter, 1997; Driscoll, 1994; Hardless et al., 2005; Holmboe & Scott, 2005; Jones & McCann, 2005; Singley & Anderson, 1989). Mathematical principles were not transferred between calculating the price of candy and change as a street vendor and taking a written mathematic test (Carraher et al., 1985). Designing principles were not transferred either from paper design to CAD design or among each figure in each medium (De Vries, 2006). Project management principles in an organization were not transferred after a large-scale of competence development training in industrial problem-based learning setting (Hardless et al., 2005). Statistical knowledge were not transferred to the last challenge question after all the lessons (Lee et al., 2006). Principles related to plea making were not transferred to a new law suit for plea-preparation after intensive training with various other cases (Hummel et al., 2004). Also, economics principles were not transferred to new cases (Stark et al., 1999). In all of these studies dealing with different subject domains, the situated learning environment has shown difficulty of transfer.
Transfer and Its Mechanism

Transfer occurs in many ways in everyday life and yet, when considering instruction and learning, achieving spontaneous transfer of learning has not been easy (De Corte, 1999; Detterman, 1993; McKeough et al., 1995). What, therefore, is transfer and how does it occur?

Different opinions and definitions exist for transfer (Barnett & Ceci, 2002; De Corte, 1999; Greeno et al., 1993; Haskell, 2001; Salomon & Perkins, 1989). While some consider transfer a “special case of learning,” others consider it as learning in various degrees with different contexts (Haskell, 2001). Also, Salomon and Perkins (1989) asserted that a clear line cannot be drawn between “mere learning” and “transfer.” However, some commonalities are apparent. Transfer involves prior knowledge already acquired, and the knowledge influences performance in other situations. In this study, transfer is, with this broad perspective, a carry-over phenomenon of previously acquired knowledge to different situations (Gick & Holyoak, 1987; Haskell, 2001).

The foundation of transfer is “similarity” (Gick & Holyoak, 1987; Haskell, 2001). Life-forms, including humans, have the ability to recognize “similarity” among different situations and transfer is possible because of the ability to recognize similarities (Haskell, 2001). One can see two different problems as being the same and use the same method employed to solve one problem to solve another (Gick & Holyoak, 1987). Similarities between two situations occur on two levels. From the surface, similarities are easily recognizable by observing any specific tangible information, such as specific numbers, story characters, etc. The structural level reveals similarities from realizing the content structures or working mechanisms of the two situations, which may or may not be similar on the surface level. Once people perceive similarities between two situations on either level, they are likely to attempt to transfer knowledge and use the same
method that works on one situation on the other. However, the attempt to transfer will fail, if the perceived similarities existed only on the surface but not on the structural level. Successful transfer will only occur when structural similarities are actually present regardless of whether or not people acknowledge them (e.g., Gick & Holyoak, 1980; Spencer & Weisberg, 1986).

Two Different Types of Transfer and Situated Learning

Salomon and Perkins (1989) suggested a framework for how humans respond to a new situation and find similarities for transfer. According to the framework, transfer occurs in two different ways “low-road transfer” and “high-road transfer.” “Low-road transfer” occurs when a new, given situation is sufficiently similar to draw automatized responses built upon numerous occurrences from prior experience. Low-road transfer is a relatively reflexive process triggered by any kind of salient familiar feature in a new situation. Repeated practice in similar situations will lead to successful low-road transfer. “High-road transfer,” in contrast to low-road transfer, occurs when a new situation prompts no automatic responses and requires exploration of the situation to deliberately search for similarities between the new situation and prior experience. Because no automatized working response is forthcoming, recognition of similarities must arise from mindful abstraction of situations by explicit decontextualization.

Based on the framework of low-road and high-road transfer, situated learning is likely to induce low-road transfer, at best, but not high-road transfer. Since the situative perspective emphasizes learning through practices in various situations rather than comprehension of principles (Brown et al., 1989), increasing successful learning experience in various situations should facilitate automaticity of courses of actions of which principles to be employed (Langer, 1978) without explicit exploration of principles. The automatized actions, then, may lead to
gaining implicit understanding that is beyond the reach of consciousness (Dianne C Berry, 1999). It is expected that the greater the degree of implicit understanding, the greater learners’ dependency on definite factual information becomes because of the lack of explicit comprehension of principle (Bereiter, 1997; Hatano & Inagaki, 1992). The surface context elements become more influential. Consequently explicit elicitation of abstraction is likely to fail when an unrecognizable, novel situation arises, even though the underlying principle is already learned. Automaticity should lead to low-road transfer attempts, at best, but not high-road transfer. Therefore, features that promote high-road transfer in situated learning model may support the model to serve its own goal more meaningfully and effectively. Because people face novel situations that require not only low-road transfer, but also high-road transfer in everyday life, the current situated learning model may only promote low-road transfer at best.

**Conditions for Successful High-road Transfer**

As previously mentioned, the foundation of transfer is finding similarities between a new situation and a prior situation. In familiar situations, similarities will be found easily, almost automatically, and low-road transfer will occur. But if no workable similarity is found, deliberate and explicit searching for similarities must occur for high-road transfer to take place. The searching will decide the transfer outcome. Several conditions are necessary for successful transfer to occur (Perkins & Salomon, 1994). While not exclusive, these conditions include: thorough and diverse practice, explicit abstraction, active self-monitoring, arousing mindfulness, and using a metaphor or analogy. Out of these conditions, people have to use explicit abstraction through a metaphor or analogy working together to find similarities for high-road transfer to occur.
Explicit abstraction is a key source of its generalizability to establish knowledge transfer phenomena. Many theoretical approaches and much research have considered and established the role of abstraction in transfer (Bereiter, 1997; Wagner, 2006). The abstraction process involves “decontextualization” by dropping detailed descriptions, or extracting basic qualities or commonalities, and by “representation” through forming those qualities into a more general symbolic manner, such as rules, principles, labels, schematic patterns, prototypes, etc.

Analogy is one of the most renowned methods of abstraction to create a link between two situations (Gick & Holyoak, 1980, 1983). Analogy establishes similarities among different contexts or situations and creates connections for conceptual understanding (Perkins & Salomon). Consequently, abstraction and analogy, working together, should elicit similarities between a new situation and a prior situation.

In order for the two conditions to work together effectively, they require learners’ deliberate mental effort (Salomon & Perkins, 1989), which is called mindfulness. Mindfulness is the opposite of automaticity; the former requires full attention and deliberate mental activities (Langer, 1978). In order to elicit abstraction from the situation, the process has to be mindful (Salomon & Perkins, 1989). To be mindful, human’s cognition needs to be alert almost all the time (Salomon & Perkins, 1989). Mindful abstraction activities can take numerous formats (Salomon & Perkins, 1989) categorized by the required level of mindfulness from effortful to effortless. Since mindfulness requires “greater cognitive capacity usage” (Kerr, 1973) and “greater mental effort expenditure” (Salomon, 1983), these intense mental activities might become a significant burden to novices. Van Merrienboer and Pass (1990) claimed an importance for supporting features that reduce the cognitive load. Clearly more investigation of
efficient and effective ways to achieve mindful abstraction through activities which induce different levels of mental effort needs attention.

Additionally, in order for the two conditions to work together effectively, the analogues used for the analogy should be comprehensible to learners (Gick & Holyoak, 1980). Using an analogy requires better understating of the analogues to construct similarities between two conditions. Chi, Bassok, Lewis, Reimann, and Glaser (1989) found that learners with high knowledge about analogues spontaneously applied the analogue knowledge to novel situations while learners with low knowledge about analogues failed to give attention to the structural similarities between analogues and the novel situation. Consequently it can be inferred that the more one knows about the analogues, the better the analogy outcome is, and the better use for high-road transfer.

Therefore, research on the effect of mindfulness for abstraction activities and knowledge about analogues used for analogy for high-road transfer is warranted. The effect of mindfulness for abstraction activities and knowledge about analogues used for analogy should also be examined for low-road transfer, too. By examining these factors together, the study will provide the limit and scope of the effect and the relationship between the two types of transfer. This is the premise which is the basis for the current research.

Purpose of the Study

The purpose of this study was to investigate the effect of different levels of mindful abstraction activities and the different levels of knowledge about analogues on both high-road and low-road transfers, and to investigate the relationship between high-road and low-road transfer.
Perkins and Salomon (1994) asserted that abstraction process must be mindful to be effective. Mindfulness demands “greater cognitive capacity usage” (Kerr, 1973) and “greater mental effort expenditure” (Salomon, 1983). Hence, mindful abstraction activities may cause learners to surpass their cognitive abilities and hinder other performances. In order to benefit from mindful abstraction activities, instructional design should consider the level of mindfulness that the activities require. However, available detailed explanation of how to perform mindful abstraction is limited (Salomon & Perkins, 1987; Van Merrienboer & Pass, 1990). An important investigative point is to discover the presence of any differences in levels of mindfulness. If any lower level mindfulness has similar effects as a higher level mindfulness, lower level mindfulness should be the suggested avenue to reduce learners’ cognitive loads.

In order to elicit abstraction effectively, analogues are used for analogy. Gick and Holyoak (1980) asserted that analogues must be understood for successful identification of analogy. However, better comprehension of analogues does not necessarily mean successful transfer. Successful transfer will only occur when appropriate connections are made through the abstraction process. If the levels of knowledge about analogues affect transfer, the selection of analogues for abstraction activities should be made accordingly.

Research Questions

1. Do different levels of mindful abstraction activities affect high-road transfer?
2. Do different levels of mindful abstraction activities affect low-road transfer?
3. Does knowledge about analogues affect high-road transfer?
4. Does knowledge about analogues affect low-road transfer?
5. Does an interaction occur between the levels of mindful abstraction activities and knowledge about analogues in high-road transfer?

6. Does an interaction occur between the levels of mindful abstraction activities and knowledge about analogues in low-road transfer?

7. Does any relationship exist between low-road transfer and high-road transfer?

Research Hypotheses

H₀₁. No significant difference will be found among groups with different levels of mindful abstraction activities in high-road transfer.

Hₐ₁-₁. The group with highest level of mindful abstraction activities, as represented by effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

Hₐ₁-₂. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

H₀₂. No significant difference will be found among groups of different levels of mindful abstraction activities in low-road transfer.

H₀₃. No significant difference will be found between groups of different levels of knowledge about analogues in high-road transfer.
Hₐ₃. The group with high knowledge about analogues will show high-road transfer significantly greater than the group with low knowledge about analogues.

H₀₄. No significant difference will be found between groups of different levels of knowledge about analogues in low-road transfer.

H₀₅. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in high-road transfer.

Hₐ₅₋₁. The group with the highest level of mindful abstraction activities, as represented by effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

Hₐ₅₋₂. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

H₀₆. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in low-road transfer.

H₀₇. No significant correlation between high-road transfer and low-road transfer will be found.

Hₐ₇. There will be a significant correlation between high-road transfer and low-road transfer.
Definitions of Terms

Transfer: Carry-over phenomenon of previously acquired knowledge to different situations (Gick & Holyoak, 1987; Haskell, 2001).

High-road transfer: Transfer occurring when a new situation draws no automatic response requiring exploration of the situation, deliberately searching for similarities between the new situation and prior experience (Salomon & Perkins, 1989).

Low-road transfer: Transfer occurring reflexively when a new, given situation is sufficiently familiar to draw automatized responses built by numerous occurrences in prior experience (Salomon & Perkins, 1989).

Mindfulness: Status of conscious awareness, which requires full attention and deliberate mental activities (Langer, 1978).

Abstraction: Process that involves “decontextualization” by dropping detail descriptions or extracting basic qualities or commonalities, and “representation” by forming those qualities into a generic symbolic manner (Salomon & Perkins, 1989).

Effortful abstraction: In this study, effortful abstraction is defined as the highest degree of mindfulness abstraction, which requires fully active mental exertion to perform a given task.
Semi-effortful abstraction: In this study, effortful abstraction is defined as medium degree of mindfulness, which requires passive mental exertion activated by guiding features, such as a partially completed task.

Effortless abstraction: In this study, effortful abstraction is defined as the lowest degree of mindfulness, which requires little mental exertion to perform a task.

Analogy: Comparison inference to find similarities in different contexts or situations and to make connections for conceptual understanding (Holyoak, 2005).

Analogue: Component that bears similarities of another component in some respect, but otherwise appears different (The American Heritage® Dictionary of the English Language, 1996). In this study, an analogue refers to the referent used for analogy in order to achieve abstraction of learning content. The commands used in word processing software that provide similar functions as the commands of HTML and CSS are analogues in this study.

Command: Pre-defined a set of instructions for computer software to perform a function. In this study, “command” refers to a command of word processing software, an element of HTML, and a property of CSS. Examples of commands for word processing software are “margin,” “borders,” “shading,” “bulleted list,” etc. Examples of commands for HTML are “paragraph element,” “unordered list element,” “heading element,” “grouping element,” etc. Examples of commands for CSS are “border-style,” “background-color,” “background-image,” “margin,” etc.
**HTML**: A universal publishing language used by the World Wide Web Universal publishing language is a language that all computers can understand globally (W3C, 1999b). HTML stands for Hyper Text Markup Language.

**CSS**: A style sheet mechanism that describes how a web-page is presented on screen, in print, or on other computer related media to a document presentation software, such as Internet browser (Bos, 2007). A style sheet can be used with a universal publishing language, such as HTML to describe the format of each element is presented. CSS stands for Cascading Style Sheets.
CHAPTER 2
LITERATURE REVIEW

Introduction

The purpose of this study was to investigate the effect of different levels of mindful abstraction activities and the different levels of knowledge about analogues on both high-road and low-road transfers, and to investigate the relationship between high-road and low-road transfer.

In order to elicit abstraction effectively, analogues are used for analogy. Gick and Holyoak (1980) asserted that analogues must be understood for successful identification of analogy. However, better comprehension of analogues does not necessarily mean successful transfer. Successful transfer will only occur when appropriate connections occur made through abstraction process.

Perkins and Salomon (1994) asserted that abstraction process must be mindful to be effective. Mindfulness demands “greater cognitive capacity usage” (Kerr, 1973) and “greater mental effort expenditure” (Salomon, 1983). Hence, mindful abstraction activities may cause learners to surpass their cognitive abilities and hinder other performances. In order to benefit from mindful abstraction activities, instructional design should consider the level of mindfulness that the activities require. However, available detailed explanation of how to perform mindful abstraction is limited (Salomon & Perkins, 1987; Van Merrienboer & Pass, 1990). An important investigative point is to discover the presence of any differences in levels of mindfulness. If any lower level mindfulness has similar effects as a higher level mindfulness, lower level mindfulness should be the suggested avenue to reduce learner’s cognitive loads.
Situated Learning Model

The basis of situated learning is that knowledge is bounded to its context in which it is employed, hence, without context, knowledge loses its meaning (Brown et al., 1989). As Lave (1985) pointed out, people learn generalized problem solving skills in everyday cognition and use them in real-life settings all the time. Learning situations should be authentic and knowledge should be used as a tool, therefore, the same as in real-life. According to this perspective, conventional educational systems, which extract knowledge from situations, will not be able to provide meaning for knowledge and its use to learners, and as a result the systems cannot promote learners’ abilities to transfer knowledge to real world situations (Brown et al., 1989). As one is exposed to many situations and practices knowledge within those situations, one builds implicit understanding of the domain in which the knowledge is used and eventually becomes an expert in the domain (Brown et al., 1989; Collins et al., 1989). This is believed to fill the gap between “knowing” and “using” and leads to meaningful learning experiences (Brown et al., 1989).

The various ways to employ situated learning share basic components. McLellan (1996) reviewed different types of situated learning environments and provided key components, which are stories, reflection, cognitive apprenticeship, collaboration, coaching, multiple practices, articulation of learning skills, and technologies. The story component provides mental learning settings to help maintain learners’ insight-laden experiences and discoveries in a sense that renders them more meaningfully memorable. Bateson (1994) asserted that a human’s life evolves around stories and learning proceeds from them. Reflection gives learners ability to think in
depth. This provides learners with time-off from the work and allows capturing “the sense of flow and immersion” (McLellan, 1996). Cognitive apprenticeship is proposed by Brown, Collins, and Duguid (1989) in an effort to “enculturate” learners just as in real, life-craft apprenticeships. Cognitive apprenticeship’s goal is to teach learners to handle complex tasks the way experts do and to emphasize the uses of knowledge. Cognitive apprenticeship incorporates other strategies such as modeling, coaching, and fading (Collins et al., 1989). Collaboration encourages learners to view the solution from various perspectives using different approaches, and collaborative skills needed in the real world. Coaching helps learners to complete a task by providing necessary assistance. Multiple practices are key points for forming implicit understanding of knowledge and its use (Brown et al., 1989). Articulation of learning goal produces effective learning with better understanding. Finally technologies are one of the central considerations of a situated learning model since they enhance the power of presenting situations to learners. These components and the model itself are not absolute nor are they exclusive as many more combinations of possibilities exist to support the model (McLellan, 1996).

The Question of Transfer

Although a situative perspective pursues “use” of knowledge in authentic situations and expects better problem solving in those situations, it has not successfully shown spontaneous empirical evidence of transfer to new situations. Rather it has been criticized for its transfer weakness (J. R. Anderson et al., 1997; J. R. Anderson et al., 1996; Bereiter, 1997; Driscoll, 1994; Hardless et al., 2005; Holmboe & Scott, 2005; Jones & McCann, 2005; Singley & Anderson, 1989).
Singley and Anderson (1989) appropriated Carraher, Carraher, and Schliemann’s (1985) study of Brazilian, child street vendors as an example to show how mathematical skills are bounded in particular situations. Carraher, Carraher, and Schliemann’s (1985) investigated child street vendors’ mathematical problem solving skills in two broadly different situations, on the street and in the laboratory. The researchers, in different contexts, visited the child street vendors and bought some candies to see if they showed mastery mathematical skills. Later the street vendors were brought to a laboratory to take a written test requiring the same mathematical skills. The researchers reported that performance was very poor on the written mathematic test while the performance was very high and consistent on the street. The comparison showed sophisticated and reliable mathematical skills with exactly the same numbers as those on the written test. While many studies that support everyday cognition report this phenomenon as an evidence of how conventional school education does not influence solving real-life problems (Carraher et al., 1985; Lave, 1977, 1985), Singley and Anderson (1989), to the contrary, saw this as an evidence of a lack of abstract knowledge resulting in no transfer to other situations.

The difficulty of transfer is also observable in other studies performed in situated learning environments. De Vries (2006) described learners’ cognitive activities and their external representation through dyads and drawings of their learning to design a desk-set using a CAD (Computer Assisted Design) program. In the study, learners did not show transfer of designing principles from paper design to CAD design, neither from one figure of the desk-set in to another figure in each paper design and CAD design. Hardless et al. (2005) failed to observe transfer of project management principles in an organization after a large-scale competence development training in an industrial problem-based learning setting. Lee, Lee, and Lau (2006) reported that while no different achievement of statistical knowledge occurred among different types of
learning environment groups, all the groups showed lower performance in the second session, post-test in which questioning about a new situation as a final challenging problem required transfer from the students. Principles related to plea making was not transferred to a new lawsuit case preparation after intensive training which used various settled cases (Hummel et al., 2004). Also, in the study of Stark et al. (1999), students showed low performance in transfer of economics principles to new cases.

Several issues regarding transfer in situated learning are possible explanations for these reported results. Among the rationales are: limited selection of situations, context boundedness, functional fixedness, and emphasis on implicit learning. These issues are all interrelated to each other, and together they influence the effectiveness and efficiency of transfer.

For the first issue, limited selection of situations, the situated learning model emphasizes multiple practices in various situations as one of the key components (McLellan, 1996). Depending on the context from which the knowledge arises, the same knowledge could have different meanings (Butterworth, 1992), and too many possible and different contexts exist to which the same retained knowledge can apply. Therefore, situated learning needs to cover variations in contexts. However, too much varied practice and other related manipulation may lead to weaker performance (Perkins & Salomon, 1987) and this could be especially true when the learning situation is highly complicated and requires intensive practice. Limitation of situation selection becomes the question of variety and frequency of situations provided; how various situations should be and how frequently the similar situations should be presented. However, some limitations apply to the number of situations and the variety of the situations presented. As Wineburg (1989) suggested, even though potential advantages exist, a well-planned situated learning environment can be “tedious, inefficient, repressive, servile, tradition-
bound, and in some cases downright mean” (p. 9). And this point of view can be true especially for lengthy projects (Driscoll, 2000, 2005). Therefore the situated learning environment must consider efficiency and variety at the same time. In other words careful selection of a limited number of situations in different contexts is one of the key determinants to success. The greater the variety, the less is the efficiency, and the narrower the variety, the greater is the possibility for better performance in limited situations; however, effectiveness is less in other situations.

The second issue is context boundedness. One of the major assumptions of situated learning is that knowledge is bounded to its context (Brown et al., 1989). Due to boundedness, learning should occur within it. However, because knowledge is learned within situations, the learners’ dependency on the context is stronger, the knowledge becomes hard to describe without blending contexts. Bereiter (1997) asserted that “progress of situated learning” leads to “fine attunement” to the particular situation. In other words, the more a learner learns and becomes experienced, the more the learner’s skills are specific to certain situations, neither broader nor more general. Bereiter provided a new store clerk’s case as an example and explained how the new store clerk mastered expertise, during a period from day one to weeks, became very specific to one store but not generally suitable for all other branch stores. Hatano and Inagaki (1992) also asserted the problem of context boundedness by indicating that it makes novices heavily dependant on salient and definite factual knowledge which would prevent transfer when for new situations in different contexts. To void too much specificity and dependency, the situated learning model suggests multiple practices in diverse situations (McLellan, 1996), however this just returns to the first issue of efficiency and variety.

The third issue is functional fixedness in problem solving, which is very closely related to context boundedness. Human mechanisms have the tendency to depend more on salient and
successful elements. Any prior experience that helped to solve problems can prevent solving a new problem by blocking the ability to see other possible solutions or other related cues beyond those already used or those that worked before (Mayer, 1991). Tripp (1993) considered possible “fossilization,” that, regardless of its incorrect understanding or use, people have a tendency to maintain the same skills as long as they are acceptable in their social settings. Fossilization leads learners to simply accept current skills and refuse to develop more in society. Consequently the individual’s fossilization lead to fossilization of the society through apprenticeship cycling (Driscoll, 2000, 2005).

The last issue is the emphasis of implicit learning in situated learning. Brown and Duguid (1996) asserted that explicit subject instruction cannot promote a “complex web of actual practice,” and situated learning will allow the expertise to be handled and learned, implicitly, in practice. Also, they asserted the conventional ways of mastering skills in educational system is “highly problematic,” because implicitness is inherent only in practice not in explicit knowledge in instruction. Accordingly, when the nature of a situation and its practices are highly complex, the explicit representation of the situation is “misleadingly partial” and may make that practice difficult or even impossible. Based on the Brown and Duguid claim, cumulating implicit understanding though practices in authentic situations is the best way to convey the complicated meaning of the situation and its representation. However, according to Berry and Dienes (1993), as implicit learning occur, generality develops under the conscious level that is not possible to access explicitly from the conscious level. Consequently it is impossible to control or manipulate deliberately the generality built through implicit learning. When implicit learning occurs in a complex situation, it causes learners difficulty in transferring their understanding to other situations because of the inaccessibility. While learners can perform tasks successfully in similar
situations, learners cannot perform in an altered situation, because no manageable control exists consciously for the variance of the situation.

All four issues, as mentioned earlier, are closely interrelated to each other and they all point to the conclusion that a situated learning environment has transfer weaknesses in its own perspective. This is problematic because the very goal of situated learning is to “use” knowledge in diverse, real-life situations. If situated learning cannot provide the power of transfer, knowledge use will be limited and cannot be used in various situations, because no two situations are exactly the same in real-life, and the variety of possible situations is almost infinite.

Transfer of Learning

Transfer and Its Mechanism

Researchers have different opinions and definitions regarding transfer (Barnett & Ceci, 2002; De Corte, 1999; Greeno et al., 1993; Haskell, 2001; Salomon & Perkins, 1989). While some consider transfer to be a “special case of learning,” others consider it to be learning in various degrees with varying contexts (Haskell, 2001). Generally speaking, transfer refers to how learned knowledge influences new and different situations or problems. This means the new, different situations are not learned nor expected to use any specific knowledge that has been learned already, yet the knowledge, somehow, influences solving the situations. The distinction between learned situation and new situation may seem clear. However, considering no situation is exactly same as before and expected to use exactly the same knowledge all the time, all new situations are different. How situations are different is a matter of degree. The distinction between “mere learning” and “transfer” becomes unclear (Salomon & Perkins, 1989). With the
same perspective, transfer is defined in this study as a carrying over phenomena of previously acquired knowledge to different situations (Gick & Holyoak, 1987; Haskell, 2001).

The foundation of transfer is “similarity” (Gick & Holyoak, 1987; Haskell, 2001). Life-forms, including humans, have an ability to recognize “similarity” from different situations and transfer similar components to novel situations because of this similarity recognition ability (Haskell, 2001). With similarity, humans can classify objects into categories, treating different objects as the same at some point, while others as different (Haskell, 2001). In the same way, one can see two different problems as being the same and use the same method employed in one problem for another (Gick & Holyoak, 1987).

According to Gick and Holyoak (1987), humans have two types of knowledge, “concepts” and “procedures.” Each concept is in at a different level between specific and general; the level is always relative to other concepts that are compared. Procedures are “operations that are adapted to achieve particular goals” (p.13). These two types of knowledge can be stored in two different formats that are “condition-action rules” and “a list of features.” They are interrelated to each other, overlap as clusters in a complicated way, and are used in daily life. Those clusters exist in various forms, such as “perceptual features, categories, procedures, principles,” and “emotional attitudes” (Gick & Holyoak, 1987 p.16). Within the interrelated network of clusters, once people perceive similarities in any component between two situations, they are likely to attempt to transfer.

Similarities between two situations can be found from the two levels of situations. From the surface level, similarities arise easily by observing any specific tangible information, such as specific numbers, story characters, etc. From the structural level, similarities arise by realizing content structures or working mechanisms of the two situations, which may or may not
appear similar on the surface level. Once people perceive similarities between two situations from any level, they are likely to attempt transferring knowledge and using the same method that works on one situation in the other. However, the attempt to transfer will fail, if the perceived similarities exist only in the surface level but not in the structural level. Successful transfer will only occur with structural similarities (Novick & Bassok, 2005), regardless of their acknowledgement (e.g., Gick & Holyoak, 1980; Spencer & Weisberg, 1986).

Two Different Types of Transfer

Salomon and Perkins (1989) suggested a framework for how humans respond to a new situation and find similarities between the new situation and prior experience to allow transfer. According to the framework, transfer occurs in two different ways, “low-road transfer” and “high-road transfer” (See Figure 1).

“Low-road transfer” occurs when a new, given situation is sufficiently similar to draw automatized responses built by numerous occurrences from prior experience. It is a relatively reflexive process triggered by any kind of salient, familiar feature in a new situation. Salient features can be anything from a story at surface level to problem solving skills at structural level, both easily perceived by automatization. Because automatization develops gradually over a long period time with frequent practice, it is a rather slow process, which is not suited for a short-range experiment (Salomon & Perkins, 1989). Repeated practice makes automatization possible and leads to successful low-road transfer for similar situations. However to give flexibility to the automatized knowledge process, the practice should be performed in somewhat varied situations. Referring to the issues about limits of situated learning in this study, the relationship between
flexibility and automatization tie closely to the issue of variety and efficiency in situation selection.

Figure 1. Two Different Ways for Transfer to Occur

“High-road transfer,” in contrast to low-road transfer, occurs when a new situation draws no automatic responses and requires exploration of the situation to deliberately search for similarities between the new situation and prior experience (Salomon & Perkins, 1989). Because the new situation does not show any working salient similarities, similarities need to be searched for and recognized through explicit effort on the structural level. To search from the structural level, one needs to decontextualize the situation to reveal the structure of the new situation. In order to understand the structure of the situation, the searching tends to be placed at the more
general level to find and analyze the structure of the situation, just like definition usually starts with a more general category to locate the element that currently needs identification. This is why humans use abstraction when searching for similarity on the structural level of a situation. Therefore, the searching process leads to abstraction to acquire more general understanding of the situation.

Salomon and Perkins (1987) examined several studies teaching programming for further transfer to describe the framework of low-road transfer and high-road transfer. For example, the studies of Pea and Kurland (1984) and Kurland, Pea, Clement, & Mawby (1986) showed perfect examples of the fact that high-road transfer will not occur until abstraction activities are required. Both studies have been conducted over long periods of time, one for two academic years. Yet the researchers in the studies failed to find transfer to other domains. To the contrary, Linn’s (1985) study showed high-road transfer resulted from activities that required students to decontextualize and analyze computer programming to locate bugs.

The study of De Vries (2006) showed how learners keep failing to transfer design principles for each figure in both paper and computer media, in a desk-set design task. She reported that “they show a preoccupation with the structure of the object rather than its functions and behaviours” (p. 222) and “lack of occurrences of deep understanding in relating representations” (p. 213). De Vries observations showed how students fail to see the underlying similarities and principles when designing each object, but become attached to the structure of each object and preoccupied by salient features, as instruction proceeded. As students learned more about how to design each figure in the desk-set, they became more skilled at drawing the shape of a figure, but kept failing to consider use and technical feasibility of the figure. According to the framework, low-road transfer occurred in drawing through practice drawings of
varied figures. However, low-road transfer had not occurred in application of the other two
design principles because the learners did not have a chance to practice enough to apply them.
Rather those principles were suggested or guided by the instructor. In fact, because those
principles were too broad and too case sensitive for each figure, the possibility of providing
enough varying practices to achieve automatization for low-road transfer may not have existed.
High-road transfer may be a solution in this case.

Based on the framework, situated learning is likely to induce low-road transfer, but not
high-road transfer. Efforts at emphasizing learning through teaching strategies and practices in
various situations (Brown et al., 1989) only increases successful learning experiences in various
situations and will facilitate automaticity, but not the ability to elicit any abstractions.
Consequently a learner can transfer the automatized skills successfully when conditions are right
for low-road transfer. However, if a new situation requires searching for similarities on a
structural level, automaticity will hinder the explicit abstraction process and the dependency on
surface contexts will make the process even harder (Bereiter, 1997; Hatano & Inagaki, 1992).
Therefore the “fine attunement” process (Bereiter, 1997) in situated learning will lead to low-
road transfer attempts, at best, but not to high-road transfer.

Context boundedness is one of the fundamental assumptions of situative perspective
(Brown et al., 1989; Butterworth, 1992; Lave, 1985, 1988; Lave & Wenger, 1991; McLellan,
1996); however it is also a fundamental source of its own weakness (J. R. Anderson et al., 1996;
Bereiter, 1997; Driscoll, 1994; Hatano & Inagaki, 1992). Considering people face novel
situations and challenges that require creative and critical thinking in everyday life, situated
learning should include features promoting high-road transfer in its model to serve its own goal.
Conditions for High-road Transfer

As mentioned earlier, the foundation of transfer is finding similarities between a new situation and a prior situation. In familiar situations similarities will be found easily, almost automatically, and low-road transfer will be attempted. But if no working similarity is recognizable, deliberate and explicit searching for similarities has to occur for high-road transfer to take place. The searching will decide the transfer’s outcome.

Several conditions are necessary for successful transfer to occur (Perkins & Salomon, 1994); while not exclusive, these conditions include most critical issues. The conditions are: “thorough and diverse practice,” “explicit abstraction,” “using a metaphor or analogy,” “arousing mindfulness,” and “active self-monitoring.” These conditions are interrelated and influence successful transfer occurrence; however, their influence is different depending on which type the transfer takes. For example, arousing mindfulness and active self-monitoring are less influential in low-road transfer than they are in high-road transfer. Mindfulness and self-monitoring are significant requirement for high-road transfer.

Thorough practice produces mastered skills showing spontaneous success of transfer but the skills are very rigid for application to various situations. Therefore, diversity should be considered to provide flexibility to the mastered skills (Perkins & Salomon, 1994). However, for novices too much diversity will result in very low achievement. Naturally the degree of diversity should not be too great for novices. Again diversity is tied to the efficiency and effect of situated learning environments. The degree of diversity and the number of situations for thorough
practice should be carefully selected and designed to balance between the efficiency and the effect for the learning environment.

The first condition raises a problem of balancing between efficiency and effect. The possible solution is to use transfer. With a limited amount of practice, learners can solve novel situations or complete new tasks if they can transfer. From the five conditions above, people have to use explicit abstraction and metaphor or analogy, working together, to find similarities in novel situations (Perkins & Salomon, 1994).

Many theoretical approaches and much research have considered and proved that abstraction is a key source for generalizability where knowledge transfer phenomena is established (Bereiter, 1997; Wagner, 2006). The abstraction process involves “decontextualization” by dropping detailed descriptions or extracting basic qualities or commonalities, and “representation” through forming those qualities into a generic symbolic manner, such as rules, principles, labels, schematic patterns, prototypes, etc. Because abstraction means “more general” and “less specified” (Salomon & Perkins, 1989), the degree of abstraction is generally relative to that which is being compared. For example, a chair is more general when compared to a red chair displayed in a shop window, but a chair is more specific when compared to furniture. In the same way, furniture is more specific when compared to equipment.

Different ways can exist to achieve abstraction, analogy is the most well known method of abstraction (Gick & Holyoak, 1980, 1983). Analogy is a comparison inference to find similarities in different contexts or situations and to make connections for conceptual understanding (Holyoak, 2005). Analogy employs a mapping process which finds matching correspondences between two comparable situations (Gick & Holyoak, 1983). According to Gick and Holyoak (1983), a representation of analogy can be described from different levels of
abstraction. When the abstraction level is high, two analogous situations are likely to match each other, because they are described on a very general level. On the other hand, when the abstraction level is low, the two analogous situations are not likely to match completely, because they are described on a more specific level, and when describing two situations from a more specific level, they are not likely to match unless they are identical situations. The ideal level of abstraction to employ analogy to elicit transfer is an intermediate one, which will provide both matching and non-matching correspondences. However, these matching and non-matching correspondences should be recognized and identified (Gick & Holyoak, 1983).

Peled and Segalis’s (2005) study showed how generating abstraction using analogy achieved high-road transfer. They observed successful high-road transfer, when the learners generated abstractions of addition and subtraction principles among different types of numbers, such as, whole numbers, fractions, and decimals. In the study, a group of learners generated a subtraction procedure from two specific subtracting procedures, each for whole number and fractions. The learners connected sub-steps to other matching sub-steps between the two situations and found the similarities between those sub-steps resulting in generation of abstraction for a subtraction procedure. The learners showed much better understanding in subtraction and better performance in transfer problems than the group without abstraction activities.

Conditions for Using Abstraction and Analogy for High-road Transfer

The two elements, analogy and abstraction, appear to be keys to successful high-road transfer. To use analogy and abstraction effectively to elicit high-road transfer, knowledge of analogous situations and mindfulness are the basic conditions for each, respectively.
Knowledge about Analogues

Using analogy to elicit abstraction should be successful when attention is given only to the solution-relevant factors between an analogue and the novel situation. Salomon and Perkins (1989) also indicated, from the perspective of schema theory, the success of transfer is influenced by the activation of schema relevant to the situation. To what extent attention will be given and which schema will be activated is affected by a learner’s knowledge about the analogue (Novick & Bassok, 2005). Chi, Bassok, Lewis, Reimann, and Glaser (1989) examined the influence of learners’ knowledge to solve problems in new situations. In the study, they found that learners with high knowledge about analogues spontaneously applied the knowledge to novel situations while learners with low knowledge about analogues failed to give attention to the structural similarities between analogues and the novel situation. Hence, the higher knowledge about analogues, the greater the successful analogy is likely to be. Gick and Holyoak (1980) also suggested that comprehension of both analogous situations is a condition for successful identification of the analogy. However possessing better knowledge representation of an analogous situation does not necessarily mean transfer. The transfer will occur only when appropriate connections are actually made to elicit abstraction.

Mindful Abstraction

In order to elicit the abstract from a situation, the process has to be mindful (Salomon & Perkins, 1989). Mindfulness is the opposite of automaticity and requires full attention and deliberate mental activities (Langer, 1978). Langer argued that a human is able to perform highly complicated behaviors without much awareness of them at a conscious level. The human mechanism allows reduction of the information needed for processing. Upon repetition, less information processing occurs, and eventually the course of action is automatized and responsive
to a cue to guide the action. When a new situation includes a cue whose redundancy is sufficient to be perceived, the course of action will take place automatically regardless of the new situation’s original goal and goal relevant information will be ignored. When “thinking” takes place in a course of action, results can be quite different than when an automatized course of action occurs without thinking.

Langer (1978) asserted that thinking will take place in a course of action when the action becomes effortful. Effortful action would occur when demand by situation is greater than an automatized action. In other words, demand of effortful action from an outside stimulus i.e., learning material, will cause learners to think. Langer exemplified Newman and Langer’s (1977) study to pointed out the importance of mindfulness by showing how different types of communication induce different effect on post-divorce adaptation. A communication style demanding active thinking about reasons of divorce affected post-divorce adaptation more than other less or none demanding communication styles.

A series of studies, completed by Gick and Holyoak (1980, 1983), showed valuable examples of mindful abstraction leading high-road transfer. In the studies, learners showed no transfer of “dispersion strategy” between military problem and radiation problem when not requiring abstraction activity. They could not see the same structural component between the two stories, when presented together, with a hint that one story might be a clue to solving the other (Gick & Holyoak, 1980). When the general principle was explicitly presented along with a story, no difference was found in learners’ performances. However, with an abstraction activity between the two stories, which connected similarities between two the stories, and provided a principle, learners showed transfer to other subjects (Gick & Holyoak, 1983).
Mindful abstraction implies that learners should “provoke” decontextualization for abstraction, but little detail is forthcoming which explains how to create this provocation (Salomon & Perkins, 1987; Van Merrienboer & Pass, 1990). Mindful abstraction activities can take numerous formats (Salomon & Perkins, 1989) but can be categorized by the levels of mindfulness required from the activities. The most effortful level includes formats that demand very active generation, such as making a map that connects all the similar components and generate principles or rules between two situations (e.g., Bassok & Holyoak, 1989; e.g., Gick & Holyoak, 1980; Gick & Holyoak, 1983; Peled & Segalis, 2005). Semi-effortful level includes formats that provide partially constructed abstractions or possible choices to consider, such as a partially worked out example (e.g., Hummel et al., 2004; e.g., Van Merrienboer & Pass, 1990). The most effortless level includes formats that provide information about abstraction explicitly, such as explicit verbal description of principles that provoke mindful abstraction (e.g., Gick & Holyoak, 1980, 1983; e.g., Langer, 1978). Since mindfulness requires “greater cognitive capacity usage” (Kerr, 1973) and “greater mental effort expenditure” (Salomon, 1983), those heavy mental activities might become a significant burden to novices. Van Merrienboer and Pass (1990) claimed an importance for supporting features that reduce the cognitive load. Clearly more investigation concerning efficient and effective ways to achieve mindful abstraction needs consideration.

Summary

Without doubt transfer occurs all the time in daily life. However, in order to facilitate transfer in instruction and learning, careful abstraction activities should be designed. Abstraction using analogy is the most successfully established activity for transfer in general (Gick &
Holyoak, 1983; Perkins & Salomon, 1994). Especially in a situated learning environment, explicit abstraction activities should be encouraged, since situated learning is likely to induce low-road transfer, at best, because of cumulative implicit understanding, context boundedness, and constraint in situation selection. In order to promote high-road transfer the abstraction activity should be mindful (Salomon & Perkins, 1989). Because mindfulness requires intensive mental effort, high level of mindfulness may become a significant burden for a novice. If a novice already possesses very well constructed knowledge representation of analogues, the knowledge benefits the novice by enabling him or her to pay attention to relative structures and reducing cognitive load. Also, the supporting features that control mindfulness for abstraction activities reduce the cognitive load for the novice (Van Merrienboer & Pass, 1990). The investigation of efficient and effective ways to achieve mindful abstraction would be a valuable contribution for promoting high-road transfer in situated learning environments.
CHAPTER 3
METHODS AND PROCEDURES

Introduction

The purpose of this study was to investigate the effect of different levels of mindful abstraction activities and the different levels of knowledge about analogues on both high-road and low-road transfers, and to investigate the relationship between high-road and low-road transfer.

Participants

The participants were 182 undergraduate students who enrolled in either a two-hundred level statistics course (n = 101) or an entry level art course (n = 81) during the spring 2007 semester in a university located in the northeastern United States. The total number of possible participants from the statistics course was 420 and 275 from the art course. According to the instructors, students from various majors in different school years elected either course as a non-major course.

The participants from the statistics course took the course in class, face-to-face, while the participants from the art course took the course online. The participants from the statistics course registered for the course to learn about general, basic statistical concepts. The participants from the art course registered for the course to learn about development of web-sites using various types of software. According to the syllabus of the art course, students learned about how to use and search in web-browsers during the period of the study, but they did not learn about
development of web-pages. Therefore, the relevancy of the art course to the study material might have influenced motivation of the participants from the course, however the content from the course prior and during the period of the study should not have affected the study results.

**Attrition**

Two hundred and forty two participants registered for the study initially. One hundred and twenty one participants were from the statistics course and 110 participants were from the art course. After review the data of the students who participated the study, data of 60 participants—23 from the statistics course and 37 from the art course—had been discarded for incompletion. Table 1 shows the types of incompletion of the discarded data for each course.

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</tbody>
</table>

Of the 60 participants who did not complete the study, 49 completed all the tests before the tutorial but did not complete either the tutorial and/or the tests. There could be many reasons for the attrition. The attrition might have been caused by lack of motivation to proceed the long
length of the tutorial or the intensity of the mindful abstraction activities. Because the participants were exposed to the tutorial, the attrition that happened after the tutorial started might have affected the study results. For example, participants from different courses might have responded differently to the tutorial and abstraction activities. Participants from the statistics course might have stopped participation easily, while participants from the art course continued. Also, participants in the group with the highest degree of mindful level of abstraction activities might have felt stronger frustration than the other groups, which would hinder the effect of the level of mindful abstraction activities if they stopped because of the frustration. Therefore, if a systematic attrition was observed, the attrition should be taken into consideration when study results were analyzed and interpreted.

In order to see the attrition for each treatment group, those participants were categorized by mindfulness and knowledge about analogues, after the cut score of the level knowledge about analogues was decided. The categorization showed attrition for each treatment group (See Table 2).

Table 2. Attrition for Groups by Levels of Mindfulness, Knowledge about Analogues, and the Types of Courses

<table>
<thead>
<tr>
<th>Level of Knowledge about Analogues</th>
<th>Level of Mindfulness</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Effortless Semi-effortful Effortful Total</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>STAT 3 ART 4 STAT 3 ART 5 STAT 3 ART 4 STAT 9 ART 13</td>
<td>22</td>
</tr>
<tr>
<td>High</td>
<td>STAT 3 ART 5 STAT 4 ART 5 STAT 4 ART 6 STAT 11 ART 16</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>STAT 6 ART 9 STAT 7 ART 10 STAT 7 ART 10 STAT 20 ART 29</td>
<td>49</td>
</tr>
</tbody>
</table>
The attrition ratio for each course is 19% for the statistics course and 33.6% for the art course. The attrition ratios of the participants who have completed all the tests before the tutorial were 16.5% for the statistics course and 26.3%. The higher ratio of attrition in both cases for the art course might have been caused by the absence of compensation even though the topic of the tutorial was relevant to the course. On the contrary, the higher attrition of the art course might indicate that the motivation of the participants who completed participation from the course was higher than the participants from the statistics course.

Based on the Table 2, the attrition for each treatment group ranged from seven to ten. The attrition for each course within each treatment group ranged from three to six. The attritions for each treatment group and for each course within each treatment group appear to be similar. Therefore the attrition appears not to affect study results for the effect of the different levels of treatments.

Research Design

Independent Variables

This study examined the effect of two independent variables: level of mindfulness and level of knowledge about analogues used for abstraction activities. The variables had three and two levels respectively. This study employed a 3x2 factorial randomized experimental research design. The levels of each variable are shown in Table 3.
Table 3. Research Design

<table>
<thead>
<tr>
<th>Knowledge about analogues</th>
<th>Mindfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effortless</td>
</tr>
<tr>
<td>Low</td>
<td>Group 1</td>
</tr>
<tr>
<td>High</td>
<td>Group 4</td>
</tr>
</tbody>
</table>

In this study, knowledge about analogues refers to knowledge about word processing software using the commands that bear similar functions as the commands of HTML and CSS in the instructional material.

The other independent variable, mindfulness, presented abstraction activities of three levels. The level of mindfulness was classified by the degrees of expected attentiveness and explicit mental effort the activity required from students.

**Dependent Variables**

The dependent variables were high-road transfer and low-road transfer.

**Material**

An individualized, self-paced tutorial entitled “Web Pages Development Using HTML and CSS Elements” was developed as the baseline material for this study. The tutorial was developed according to the principles behind situated learning and included the following attributes: authentic tasks presented via scenarios, reflection opportunities, cognitive apprenticeship, modeling, and multiple practices. There were two parts to the materials: the two
working scenarios in which participants played the role of a newly hired web developer and learned how to make a web-page using HTML and CSS commands, and the testing scenarios in which the participants developed two web-pages by themselves based on what they learned.

A web site was created to provide access to the tutorial. The web site provided two types of navigational features supporting different parts of the web-site. The first navigational feature did not allow participants free access from the part that participants were working to parts that the participants had already completed. The parts supported by the first type of navigational feature were registration, background survey, prior knowledge test, two working scenarios, first test scenario, and second test scenario. The second navigational feature allowed participants to access certain parts any time as many as they wanted and returned to the previous part that they were working on. The parts supported by the second type of navigational feature were sign-in, help, and communicating to the investigator.

The web site enabled participants to create a participating identification (ID) and a password. The web site recorded personal progress for each ID. Whenever participants signed-in, check marks were displayed next to the pages visited according to the individual’s progress (See Figure 2). This feature allowed participants to use the web site at their convenience as often as they wanted. Also, this feature allowed participants to browse freely within each part and encouraged the completion of the tutorial when participants tried to move to the next part without completing the current part. For example, if participants tried to move to the test scenario part without visiting all the pages or submissions of all the abstraction activities required, the web site would remind participants that there were unvisited pages or incomplete submissions and ask them to visit the pages and complete the submissions before moving to the next scenario (See Figure 2).
The web site provided two types of submission forms: activity submission form (see Figure 3) and web-page coding submission form (see Figure 4). The activity submission form appeared only in the group with semi-effortful abstraction activities and the group with mindful abstraction activities. The web-page coding submission form appeared in all the groups for participants to submit their test results.

The page containing a submission form required participants to press the “submit” button after typing in the content in order for the web site to recognize the submission page as completed. Without pressing the “submit” button, the submission page would not be checked as visited, consequently the web-site would ask the participants to go back to the page and submit the content. All the submissions could be done more than one time within each part. The system would update the data with the more recent submission, however, once participants moved to the next part they were not allowed to return to the any previous parts and resubmit.
In order to support individual difficulties, a communication feature was provided. An individual participant could send a message to the investigator and receive an individual response (See Figure 5). Nine participants used this feature to communicate with the researcher. Eight questions were about difficulties in sign-in, use of tutorial, or compensation, and answered
by the researcher. One question was about problem using a CSS command and was not answered because the researcher’s answer could affect the individual’s performance. The last question was responded with the brief explanation about why the researcher could not answer to the question.

Figure 5. Communication Feature

Detailed descriptions about content, development of tutorial, and the tutorial follow.

**Content**

The content included 15 commands from HTML (see Table 4) and 15 commands from CSS (See Table 5). The selected commands are the very basic commands used in most web-page development situations. Content development was based on the specifications for web development in both HTML and CSS from the World Wide Web Consortium (W3C). The content for HTML followed HTML 4.01, 12/24/1999 version (W3C, 1999b) and the content for CSS followed CSS 2.1 spec, 11/04/2006 version (W3C, 2006). Also, the content reflected the guidelines of W3C’s recommendations and standards (1999c; W3C, 2000a, 2000b, 2000c,
2000d) for web page design principles. Consultation with two professional experts verified that if the content of the lessons match these guidelines for this study.

Table 4. List of HTML Commands Selected for the Content

<table>
<thead>
<tr>
<th>Command Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTML</td>
<td>Declares the beginning and ending of the web-page</td>
</tr>
<tr>
<td>HEAD</td>
<td>Includes the information about the web-page</td>
</tr>
<tr>
<td>TITLE</td>
<td>Includes the web-page title information</td>
</tr>
<tr>
<td>BODY</td>
<td>Includes the all content displayed on the screen</td>
</tr>
<tr>
<td>STYLE</td>
<td>Includes the styling information of the any specific part of the web-page</td>
</tr>
<tr>
<td>H1</td>
<td>Declares the beginning and ending of a first level heading</td>
</tr>
<tr>
<td>H2</td>
<td>Declares the beginning and ending of a second level heading</td>
</tr>
<tr>
<td>H3</td>
<td>Declares the beginning and ending of a third level heading</td>
</tr>
<tr>
<td>P</td>
<td>Declares the beginning and ending of a paragraph</td>
</tr>
<tr>
<td>IMG</td>
<td>Includes a location of an image file for display on the web-page</td>
</tr>
<tr>
<td>A</td>
<td>Includes attribute information, such as hyper link address</td>
</tr>
<tr>
<td>BR</td>
<td>Forces a line break</td>
</tr>
<tr>
<td>UL</td>
<td>Declares the beginning and ending of a unordered list</td>
</tr>
<tr>
<td>EM</td>
<td>Declares the beginning and ending of tests that emphasized font style</td>
</tr>
<tr>
<td>DIV</td>
<td>Groups several parts of a web-page into one</td>
</tr>
</tbody>
</table>

Table 5. List of CSS Commands Selected for the Content

<table>
<thead>
<tr>
<th>Command Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>background-color</td>
<td>Sets the background color of an element</td>
</tr>
<tr>
<td>background-image</td>
<td>Sets the background image of an element</td>
</tr>
<tr>
<td>background-position</td>
<td>Sets the starting position of the background image of an element</td>
</tr>
<tr>
<td>background-repeat</td>
<td>Sets if and how the background image will be repeated in an element</td>
</tr>
<tr>
<td>color</td>
<td>Sets the foreground color of an element</td>
</tr>
<tr>
<td>border-style</td>
<td>Sets the border line style of an element</td>
</tr>
<tr>
<td>border-width</td>
<td>Sets the border line width of an element</td>
</tr>
<tr>
<td>border-color</td>
<td>Sets the border line color of an element</td>
</tr>
<tr>
<td>font-size</td>
<td>Sets the size of font</td>
</tr>
<tr>
<td>font-family</td>
<td>Sets the name of font-family</td>
</tr>
<tr>
<td>float</td>
<td>Sets an element free from the display rule and floats any side either right or left</td>
</tr>
<tr>
<td>list-style-type</td>
<td>Sets the type of the list-item marker</td>
</tr>
<tr>
<td>margin</td>
<td>Sets the space between the content border and its surrounding element</td>
</tr>
<tr>
<td>padding</td>
<td>Sets the space between the content border and its actual content</td>
</tr>
<tr>
<td>text-align</td>
<td>Aligns the text in an element</td>
</tr>
</tbody>
</table>
Tutorial Development

A task analysis was conducted to determine the topics, sub-topics, sequence of the topics that needed to be covered for two working scenarios and two testing scenarios. The task analysis was 50 pages long with 23,480 words in 2,358 lines. APPENDIX F includes the detailed task analysis for the second test scenario. The results of the task analysis were used as a basis for establishing content validity of the testing scenarios, and constructing validity for high-road and low-road transfer scoring checklist. Detailed description about the checklist is provided in the assessment instrument section.

The tutorial was divided into four major parts: scenario, expert, resources, and individual practice as shown in Figure 6.

Figure 6. Tutorial Structure
The tutorial contained approximately 17,256 words; the first scenario consisted of 13 web-pages including scenario, web page checklist, rough sketch, expert’s tutor, and step-by-step procedures. The second scenario consisted of 12 pages providing the same features. The detailed description for each part follows.

Tutorial

Scenarios

The tutorial provided two working scenarios. Both scenarios contained authentic tasks that an actual web-developer would face in a real workplace. Participants assumed the role of a newly hired web-page developer. The “company” that hired the new web developer had an “expert, a senior developer” who would guide the new developer as they completed the task.

Participants were required to create a web-page for a novel writer who was going to participate in a “Meeting with the Author” event in a community library (See Figure 7). She wanted to have a web-page with some intriguing text and a few pictures from one of her books for advertisement. The author explained her upcoming event including the purpose of the event, her purpose for creating a web-page, the placement for the web-page, how the web-page would be used, etc. She possessed some knowledge and experience with web-page development and expressed her needs very specifically and explicitly.

In second scenario, participants were required to create a web-page for a restaurant owner who wanted to expand the promotion of his establishment to the Internet (See Figure 8). The restaurant owner had never had a web-site for his restaurant before. Now that his restaurant had settled down, he wanted some initiation into this “new” way of advertisement. He was
inexperienced with developing web pages, and therefore, his requests were less specific and less explicit than that of the earlier scenario.

Figure 7. Story of a Client in the First Working Scenario

Figure 8. Story of a Client in the Second Working Scenario
**Expert**

An expert tutored participants throughout the entire tutorial (See Figure 9). He was very knowledgeable and had much experience in web-page development. He helped participants with what to consider in designing page layout, which HTML and or CSS command to use, and how to use them to fulfill clients’ requests. In the beginning of the tutorial, the expert’s guidance was very specific (See Figure 10). This guidance became less specific as the scenario proceeds to the end. The expert tutored participants about what a certain element does in a certain situation, step-by-step procedures of what to do, coding examples, and visual aids for detailed illustrations (See Figure 11).

*Figure 9. Expert’s Greeting*
Figure 10. An Example of Specific Guidance at the Beginning of the Tutorial

Figure 11. Expert’s Guidance with Coding Examples and Visual Aids
Resources

In both scenarios, participants were allowed to download the information provided by the tutorial for individual web-page development practice. The information included rough sketches, images and texts for the web-page development for each scenario, the list of a client’s request, the lists of commands, etc. Most of the information was embedded in the tutorial along with necessary directions for downloading. For example, participants could download a rough sketch shown in the Figure 10 and make a reference for their web-page development during the individual practice. The tutorial provided a link to the lists of HTML and CSS commands used in the tutorial (see APPENDIX E), and the code-numbers of standard web-colors in every page as references. Participants could either visit the reference page whenever they wanted or download the page for use at their convenience.

Individual Practice

Within each scenario, participants had individual practice following the expert’s guidance to make a web-page using the codes described in the instruction. They could copy the coding examples (see Figure 11) and paste them to their web-page coding for experimentation. Participants could use any text editing software such as “Notepad” or “WordPad,” to make their own web-pages. After participants completed their web-page, they submitted the web-page coding through the built-in submission form provided by the web-site (see Figure 4). Depending on the values and options of commands that each participant used, the individually completed web-pages could be different in appearance. However the basic layout design would be same if the participant followed the expert’s guidance. Figure 12 and Figure 13 show a web-page submitted after individual practice for each working scenario.
Within each scenario, commands had repeated use to provide enough practice. Also, the same commands had slightly different use during the entire tutorial to represent variations in use of the same elements.
Treatment

Abstraction Activities

The three treatments consisted of three different levels of mindful abstraction activities. The abstraction activities either “showed” or “abstracted” the similarities between the functions of commands in HTML and CSS markup language and word processing software (see Figure 14). Word processing software consists of various commands. Many of the commands share similar functions with the commands of HTML or CSS. For example, the command, “shade,” in word processing software has a function that fills a background color of texts and table cells. The function of “fills a background color” is similar to the function of the command, “background-color,” of CSS, which is filling a background color of any HTML elements. Even though their name and how they display a background color for the selected element are different, the two commands share a similar function.
Figure 14. Abstracted Similarities in Functions of Commands between the Two Types of Documents

Placement of these abstraction activities was based on data from the pilot test which consisted of 29 undergraduate students at the same university in the northeastern United States and followed the same procedures as the main study except for the intervention activities. Test results showed item difficulties of checkpoints that reflect the clients’ requests from the test scenarios. Sixteen checkpoints indicated their item difficulties .500 or less. A checkpoint with item difficulties .500 or less was reviewed from task analysis (e.g. APPENDIX F) to identify
HTML and CSS commands needed to complete the checkpoint. Eight HTML and CSS commands were identified from the checkpoints analysis. Table 6 and Table 7 show item analysis results including checkpoints for low-road transfer and high-road transfer, item difficulties of each checkpoint, commands needed to complete the identified checkpoints, and the summarized commands for intervention development.

Table 6. Item Analysis Result for Low-road Transfer

<table>
<thead>
<tr>
<th>Checkpoint</th>
<th>Item Difficulty</th>
<th>Commands Needed</th>
<th>Summarized Commands for Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Scenario (6 Checkpoints)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Make a border line.</td>
<td>.621</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Place all the content in the middle (not center aligning).</td>
<td>.724</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Color the background.</td>
<td>.069 background-color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Assign 70% of the width of the window for the width of the main content area</td>
<td>.793 background-color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Assign ‘times’ font to the title.</td>
<td>.828</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Place little fan images in the main content area, right above the page</td>
<td>.586</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Scenario (9 Checkpoints)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Make the web page title ‘Kelly’s Home’</td>
<td>.586 background-color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Contain the book title, ‘Everything with Chocolate’ in the main content area</td>
<td>.724 background-color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Contain the description of the book, ‘Everything with Chocolate’ in the main content area</td>
<td>.759 background-color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Color the background</td>
<td>.690</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Place the menu bar on the left side</td>
<td>.655</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Make the menu bar width fixed</td>
<td>.552</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Place the title in the middle on top of the page and above the menus bar and the main content</td>
<td>.586 background-color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Insert the background picture in the menu bar</td>
<td>.621</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Add a blank link (href=” ”) for each link</td>
<td>.517</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Note: the shaded checkpoint show item difficulty .500 or less
Table 7. Item Analysis Result for High-road Transfer

<table>
<thead>
<tr>
<th>Checkpoint</th>
<th>Item Difficulty</th>
<th>Commands Needed</th>
<th>Summarized Commands for Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Scenario (1 Checkpoints)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Present the background color only outside of the border line</td>
<td>.034</td>
<td>div, background-color</td>
<td></td>
</tr>
<tr>
<td><strong>Second Scenario (9 Checkpoints)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Contain 5 major parts for main-menu</td>
<td>.207</td>
<td>list, padding, margin</td>
<td></td>
</tr>
<tr>
<td>3. Contain the list of 8 book titles for sub-menu title</td>
<td>.103</td>
<td>list, padding, margin</td>
<td></td>
</tr>
<tr>
<td>4. Place the sub-menus below the main-menu item, called ‘My Books’</td>
<td>.172</td>
<td>list, padding, margin</td>
<td></td>
</tr>
<tr>
<td>5. Make the list of the book title links (sub-menus) looks differently</td>
<td>.103</td>
<td>list, padding, margin</td>
<td></td>
</tr>
<tr>
<td>than the main-menu</td>
<td></td>
<td>padding, margin</td>
<td></td>
</tr>
<tr>
<td>6. Make those five rectangles look like buttons without any graphics</td>
<td>.000</td>
<td>background-color</td>
<td></td>
</tr>
<tr>
<td>7. Make plain solid color rectangles for the 5 main menus</td>
<td>.000</td>
<td>background-color</td>
<td></td>
</tr>
<tr>
<td>8. Place all the content in the middle of the screen</td>
<td>.517</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Place the menu area and the main content area not to touch each other</td>
<td>.000</td>
<td>div, margin</td>
<td></td>
</tr>
<tr>
<td>10. Place the white main content area on the right side</td>
<td>.000</td>
<td>div, float border-style</td>
<td></td>
</tr>
<tr>
<td>11. Make a drop shadow (dark lines) right under the menu bar</td>
<td>.000</td>
<td>border-style</td>
<td></td>
</tr>
<tr>
<td>12. Make a drop shadow (dark lines) right under the main content area</td>
<td>.000</td>
<td>div, border-style</td>
<td></td>
</tr>
<tr>
<td>13. Make a white main content area</td>
<td>.000</td>
<td>div, background-color</td>
<td></td>
</tr>
<tr>
<td>14. Place all the links in the menu bar only in the white space of the</td>
<td>.000</td>
<td>div, padding</td>
<td></td>
</tr>
<tr>
<td>image (not go over)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Make the menu bar always shows both top and bottom images even for</td>
<td>.000</td>
<td>div, background-image</td>
<td></td>
</tr>
<tr>
<td>the shortest list</td>
<td></td>
<td>(or div, margin/padding)</td>
<td></td>
</tr>
<tr>
<td>16. Make the bottom part of background image of the main-menu moving up</td>
<td>.000</td>
<td>div, background-images</td>
<td></td>
</tr>
<tr>
<td>and down flexibly</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Note: the shaded checkpoints show item difficulties .500 or less

For those identified commands, matching analogues that provide same functions were selected for abstraction generalizations. Table 8 shows descriptions of one of the selected commands and its analogue, and the abstraction generalized from the two descriptions. The first column describes the characteristics of the CSS command, “background-color,” in a web-page document. The last column describes characteristics of a command, “shading,” that serves same function in a word document. The middle column shows the generalized abstraction from the first and the last columns. The selected analogues and generalized abstractions were reviewed by
two experts for validation. After the abstraction process, the three different levels of mindfulness activities were developed.


<table>
<thead>
<tr>
<th>Web-page Document</th>
<th>Abstraction of “background-color”</th>
<th>Word Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Element:</td>
<td>Dark brown web-page background</td>
<td>Applied Element:</td>
</tr>
<tr>
<td></td>
<td>color</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td>It shows dark brown color at the</td>
<td>Description:</td>
</tr>
<tr>
<td></td>
<td>back of the web-page</td>
<td>It shows the selected color at the back of the selected element</td>
</tr>
<tr>
<td>Function:</td>
<td>Decorate the page with a color</td>
<td>Function:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draw attention, or to separate the space by filling the selected color</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draw attention than the rest of the text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Separate the space between the main text and the text in the box</td>
</tr>
</tbody>
</table>

All eight abstraction activities were placed in the tutorial. The abstraction activity for a command was placed right after the second practice.

*Development of the Three Levels of Mindful Abstraction Activities*

These interventions (e.g. Table 8) were modified in three ways based on the level of mindfulness.
Effortless Level of Mindful Activity

In the effortless level of mindfulness, explicit descriptions of analyzed situations and elicited abstraction were presented (See lower right section of the Figure 15). A brief description of the abstraction process was presented above the abstraction table along with a statement encouraging participants to make their own tables. However, there was neither an obligation to make a table and submission form provided for a table. Participants were only required to visit this page in order to complete the tutorial. If they did not visit this page, the web site would ask to visit the page before moving to the next part.

Semi-Effortful Level of Mindful Activity

In semi-effortful level of mindfulness, the activity included the analysis of a web-page document, a word document, and an empty column for generalized principles. Participants were
asked to review the analyses of both documents and generalize abstraction based on the analyses (See the lower right section of the Figure 16).

**Effortful Level of Mindful Activity**

In this level of mindfulness, characteristics of a command in web-page document and the analogue that matches to the command in the word document were not presented. Abstraction from both documents was not presented either. Both a command and the matching analogue appeared with no additional information except directions for how to describe the
characteristics of the command and its analogue in each document and generalize abstraction from the analyses (See lower right section of Figure 17).

Figure 17. Active Generation of Abstraction for Effortful Level of Mindful Activity
Assessment Instruments

Background Survey

The survey consisted of 12 questions which asked about web page development-related experience and using documentation software, in general. The survey included questions about general computer use experience, web page development experience using various applications including HTML and CSS, and using word processing software experience (See APPENDIX A).

Analogue Knowledge Test

The “Knowledge about Using Microsoft Office Word” test consisted of 15 questions which asked how to use the commands of Microsoft Office Word, which would be used as analogues in the tutorial (See APPENDIX B). Each question provided a simple word documentation situation that would need a certain command. Each correct response was worth one point. The total possible score was 15. From the study, the Cronbach alpha reliability coefficient of the analogue knowledge responses was .806.

Prior Knowledge Test

To check prior knowledge of web-page development, a test consisting of 12 items concerned HTML and CSS was conducted. This test assessed knowledge about commands identified for abstraction activities and basic commands used for developing a web-page (See APPENDIX C). The total possible score was 12. From the study, the Cronbach alpha reliability coefficient for the responses on the prior knowledge test was .735.
High-road Transfer and Low-road Transfer Test

In order to measure high-road and low-road transfer, two test scenarios were developed (see APPENDIX D), in which participants were required to create web-pages without any guidance. Once those web-pages were submitted, they were evaluated based on a checklist developed for each type of transfer. Detailed description for the test scenarios and the checklists follow.

Transfer Test Scenarios

The test scenarios followed the same format of and stories from the working scenarios in the tutorial. The same characters from the two working scenarios requested participants to make either a modification or a new web-page. All of the requirements in the two test scenarios could be solved only with the codes that participants had learned during the tutorial. However, the clients’ requests were more complicated, which, in order to meet the requirement, required participants to do more than just the simple application of what they had practiced during the tutorial.

The first test scenario was a continuation of the story in the second working scenario. The restaurant owner received the web-page that he requested in the second working scenario and wanted some changes made on the page (see APPENDIX A for detailed story). All seven changes were requested including addition of a border line around the entire content aligned in the middle of the web-page, narrower margins on left and right sides, and so on. Each request became a checkpoint later for assessment of the first test. See the next section, “Transfer Test Scoring Checklist,” for detailed description of the checkpoints for the first test.
The second test scenario was a continuation of the story in the first working scenario. Unlike the first test scenario that required participants to change the web-page that was already developed, the second test scenario required participants to create a new web-page. The novel writer was satisfied with the book advertisement web-page developed in the first working scenario, so she asked for a personal home page (see APPENDIX A for detailed story). The request consisted of 26 conditions to meet the requirement. Each condition became a checkpoint later for assessment, just like the ones in the first test scenario. The request included making buttons for main-menu and sub-menu on the left side of the screen, inserting an image for the menu bar that would not overlap the menu items, making a drop shadow for each text box, and so on. See the next section, “Transfer Test Scoring Checklist,” for detailed description of the checkpoints for the second test.

In the two tests, some requirements were similar to the ones in the working scenarios. Therefore identifying the commands that would meet the requirements was relatively clear. However, in order to complete the request, participants needed to identify the appropriate positioning of the commands. For example, participants had a chance to practice the CSS command, “border-style,” to add a borderline in the two working scenarios. They practiced the command to draw a borderline around a web-page, a list, and a group of texts and images (see Figure 12 and Figure 13). So, identifying the command, “border-style,” to add a border line around the entire content in the first test scenario was clear. However, what they had practiced was to add the command to the designated HTML elements (e.g. body element, list element, group element) that were already made for other purposes. In this test scenario, the HTML element for which participants needed to add the command did exit. Participants had to recognize this problem: the absence of the HTML element that the command should designate,
and making the appropriate HTML element that would satisfy the requirement. This action would require low-road transfer (see APPENDIX G).

On the other hand, some requirements were very different on the surface, appearing to require new functions or the purposes that had not yet been encountered during the tutorial. These requirements showed no indication which codes would serve the functions or purposes to accomplish the request based on what was learned in the tutorial. For example, in the second test scenario, the author requested making a drop shadow without using graphics for each text box. Because making a drop shadow had not been introduced in the tutorial, this situation was new to the participants. In fact, if participants realized the underlying principle of the same command, “border-style,” which is drawing a line on any side of an HTML element with any color and shape, they should have been able to use the command with the side options (e.g. only to the bottom and left side, different color on all four sides, etc.) to make a drop shadow. Participants should have been able to recognize the function required in the request and the principle that would serve the function. After that, they should have been able to recognize or make the appropriate HTML element, using the appropriate command. The action would require high-road transfer (see APPENDIX G).

Transfer Test Scoring Checklist

A checklist was used to evaluate the students’ web pages which measured high-road transfer and low-road transfer (See Table 9 and Table 10). The checklist consisted of 31 checkpoints reflecting all the requirements as requested by the clients in the test scenarios. Each checkpoint was analyzed for type of transfer. The checkpoints that required the same function or purpose as what participants practiced during the tutorial only in a different situation were classified as low-road transfer. The checkpoints that required a different function or purpose than
what participants practiced during the tutorial were classified as high-road transfer. The task analysis of two web-pages in the working scenarios and two web-pages in the test scenarios provided information that enabled a comparison of the two to determine differences and similarities in functions, purposes, and usages of the same command. APPENDIX G shows the comparison of the two.

Sixteen checkpoints were identified as requiring high-road transfer and 15 checkpoints were identified as requiring low-road transfer. Each successful checkpoint was worth one point. The test reliability for low-road and high-road were .656 and .587 respectively.

Table 9. Checklist for Low-road Transfer

Checkpoints for first scenario (6 checkpoints)
1. Make a border line
2. Place all the content in the middle (not center aligning)
3. Color the background
4. Assign 70% of the width of the window for the width of the main content area
5. Assign ‘times’ font to the title
6. Place little fan images in the main content area, right above the page

Checkpoints for the second scenario (9 checkpoints)
7. Make the web page title ‘Kelly’s Home’
8. Contain the book title, 'Everything with Chocolate' in the main content area
9. Contain the description of the book, 'Everything with Chocolate' in the main content area
10. Color the background
11. Place the menu bar on the left side
12. Make the menu bar width fixed
13. Place the title in the middle on top of the page and above the menus bar and the main content
14. Insert the background picture in the menu bar
15. Add a blank link (href=‘ ‘) for each link

For example, checkpoint 1 in Table 9 is classified as low-load transfer because participants have practiced the border-style command to draw lines around the content in
working scenarios, even though the situation is not exactly identical. On the other hand, checkpoint 6 in Table 10 is classified as high-road transfer, because participants have to alter their views of “border-style” command to make each menu item into a button, which they had never practiced in the working scenario.

Table 10. Checklist for High-road Transfer

Checkpoints for first scenario (1 checkpoint)
1. Present the background color only outside of the border line

Checkpoints for the second scenario (15 checkpoints)
2. Contain 5 major parts for main-menu
3. Contain the list of 8 book titles for sub-menu title
4. Place the sub-menus below the main-menu item, called ‘My Books’
5. Make the list of the book title links (sub-menus) looks differently than the main-menu
6. Make those five rectangles look like buttons without any graphics (padding, no bullet)
7. Make plain solid color rectangles for the 5 main menus (border-style, background-color)
8. Place all the content in the middle of the screen
9. Place the menu area and the main content area not to touch each other
10. Place the white main content area on the right side
11. Make a drop shadow (dark lines) right under the menu bar
12. Make a drop shadow (dark lines) right under the main content area
13. Make a white main content area
14. Place all the links in the menu bar only in the white space of the image (not go over)
15. Make the menu bar always shows both top and bottom images even for the shortest list
16. Make the bottom part of background image of the main-menu moving up and down flexibly

Validation

To validate the classification into low-road and high-road transfer, two professional web-page developers and one instructional designer who was knowledgeable in web page development were asked to 1) review both working and test scenarios, 2) review the checkpoints,
3) identify the commands required for completion of each checkpoint, 4) identify the functions of each command for the each checkpoint, 5) compare functions of a command used in test and in tutorial, and 6) classify the checkpoints into either low-road transfer or high-road transfer.

There were disagreements in five of the 31 checkpoints. With 84% agreement, three reviewers agreed on most of the checkpoints except checkpoint 2 for low-road transfer (See Table 9), and checkpoint 1, 2, 3, and 10 for high-road transfer (See Table 10). Three validators came to consensus on the checkpoints in question by consulting the original definitions of both types of transfer and a discussion.

Procedures

Participants were recruited from 695 students (420 from a statistics course and 275 from an art course) in two courses, one face-to-face statistics course consisting of seven sections taught by two instructors, and an online art course taught by one instructor. Students received a recruitment announcement e-mail from their instructors (See APPENDIX H). The e-mail included a simple introduction to the investigator, the purpose of the study, and a link to the study’s web-site for more detailed information. Also, the e-mail noted that participation was voluntary and students who wished to participate needed to visit the web-site for registration.

Each class had different compensation. Participants from one section of the statistics course received 30 extra credit points out of 1000 and six other sections of the statistics course taught by a different instructor received $10 in cash per person. Participants from the art course received no compensation. Due to the different types of compensation, students from different courses or sections received a different web-site address according to the type of compensation.
These web-sites had the same content but different consent forms. Regardless of web-site address, students could access this web-site from any place with an internet connection.

Participants followed the procedure shown in Figure 18. Participants visited the web-site (http://www.isdlink.org/ae, http://www.isdlink.org/af, or http://www.isdlink.org/ag) to register and create a participating identification with a password to begin the tutorial once they reviewed the information and consent form (See APPENDIX I) and decided to participate. As they registered, they were randomly assigned to a group between 1 and 6 by a web-program that generates random numbers automatically.

Figure 18. Procedure for the Study

After registration, participants completed the background, knowledge about using Microsoft Word, and the knowledge test about prior web-page development. At the end of each test an online program checked the completion status, and if any unanswered item remained the program asked the participants to go back and complete the question.

The participants then proceeded to the actual tutorial by pressing “Move to the Next Phase” button. During the tutorial, participants followed the expert’s instruction, made their own web-pages for practice, submitted abstraction activities, if required, and submitted a completed practice web-page for each scenario. Within each working scenario, participants could browse any page they choose as many times as they wished. They could leave the web-site and log-in to the site using their registered ID as many times as they wished. However, once they completed
the tutorial and proceed to the test part, participants could not return to the any page of the tutorial.

When participants completed the tutorial and submitted all the requirements, they then moved to the final tests by pressing the “Move to the Next Phase” button. The first test scenario presented a client’s story along with directions for using the coding submission form. Participants could submit as many times as they wanted. However, once participants proceeded to the next test scenario, they could not return to the first test scenario and submit again. When they submitted the last web page coding, their participation in the study ended with a statement of appreciation and confirmation of the end of the study. All procedures were followed at the participants’ own pace, but within a seven-day limit.

Data Analysis

After all the data were collected and scored, data was categorized and analyzed using SPSS releasing version 11.

Descriptive Statistics

Descriptive statistics were run for measurements including background survey, knowledge about analogues, prior knowledge, low-road transfer, and high-road transfer. Descriptive statistics for the results of the background survey were used to describe the participants in terms of attributes that may influence how well participants perform on the high-road transfer and low-road transfer. Description included general perception about using a
computer, experience and general perception of using word processing software and developing web-pages.

Descriptive statistics for knowledge about analogue were used to categorize the participants into two groups of high and low and to describe the data in terms of means and frequencies for each group.

Descriptive statistics for prior knowledge were used to describe how knowledgeable participants were with using HTML and CSS, and to examine differences of prior knowledge among groups by levels of mindfulness and knowledge about analogues.

Descriptive statistics for low-road transfer and high-road transfer were run to describe how well participants performed on the final test.

Effect of Mindfulness and Knowledge about Analogues on High-road and Low-road Transfers

To investigate effect of mindfulness and knowledge about analogues on high-road and low-road transfers, two-way MANCOVA was used. To justify the use of MANCOVA, assumptions were tested.

\( H_{01} \). No significant difference will be found among groups with different levels of mindful abstraction activities in high-road transfer.

\( H_{a1-1} \). The group with highest level of mindful abstraction activities, as represented by effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.
H\textsubscript{a1-2}. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

H\textsubscript{02}. No significant difference will be found among groups of different levels of mindful abstraction activities in low-road transfer.

H\textsubscript{03}. No significant difference will be found between groups of different levels of knowledge about analogues in high-road transfer.

H\textsubscript{a3}. The group with high knowledge about analogues will show high-road transfer significantly greater than the group with low knowledge about analogues.

H\textsubscript{04}. No significant difference will be found between groups of different levels of knowledge about analogues in low-road transfer.

H\textsubscript{05}. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in high-road transfer.

H\textsubscript{a5-1}. The group with the highest level of mindful abstraction activities, as represented by effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.
Ha5-2. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

H06. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in low-road transfer.

**Test of Assumptions**

Covariate analysis is used when the effect of dependent variables are confounded by other variables other than independent variables. Controlling these variables by using them as covariates, the effect of independent variables will be clearer. Variables that vary systematically with independent variables or are known to influence dependent variables can be used as covariates. Because prior knowledge about HTML and CSS influences web-page development, prior knowledge was used as a covariate to clear the effect of levels of mindfulness and knowledge about analogues. Correlation between prior knowledge and knowledge about analogues was examined for systematical variation between the two variables. Also, differences of prior knowledge for groups by levels of mindfulness and knowledge about analogues were examined because significantly different prior knowledge levels among groups would imply significantly different influences to performances among groups.

Multivariate analysis can be used to investigate the effect of independent variables in combination with dependent variables. This analysis should be used when relationship of dependent variables are expected. Because low-road transfer and high-road transfer could influence to each other on web-page development, correlation between high-road and low-road
transfers was examined. Also, multicollinearity was checked to determine if the dependent variables showed exceeding correlation. Exceeding correlation could indicate inability of dependent variables measuring different constructs. Hence if the correlation value was greater than .90, the dependent measures should be considered as one variable (Brace et al., 2003).

Multivariate analysis assumes homogeneity of two variances. To test homogeneity of covariance matrices among groups, Box’s test was conducted. To test homogeneity of variances among groups, Levene’s test was conducted. If Levene’s test indicated a significant difference in variances among groups, the test results would be double checked by dividing the squared highest variance with squared lowest variance (highest SD² ÷ lowest SD²). A resulting value of less than 2 allows tenure of the assumption of homogeneity (Field, 2005).

Multivariate analysis assumes also that distribution of all the dependent variables have multivariate normality with groups as well as univariate normality within each group. Because multivariate normality cannot be tested on SPSS, Field (2005) suggested to check the assumption of univariate normality for each dependent variable. Univariate normality of each dependent variable was checked using the z-score of skewness for the dependent variable. A z-score of skewness less than 1.96 was considered normal and the value equal or greater than 1.96 was considered non-normal at p < .05 (Field, 2005). If the assumption of normality was violated, Mann-Whitney U, a non-parametric test, would be necessary to confirm the significance of the effect.

Analysis of Variables

Two-way MANCOVA was conducted to investigate the effect of mindfulness and knowledge about analogues on low-road transfer and high-road transfer, using prior knowledge as a covariate.
Two-way ANCOVA for each dependent variable was conducted as a follow-up analysis. Adjusted means and standard deviations were computed for the groups with the variable shown a significant difference by partialling out the effect of the covariate. Based on the adjusted means, the analysis was followed by Bonferroni corrected post hoc comparisons to examine where the difference exists among groups, if required. The alpha level of significance for all hypothesis testing was set at the .05. To confirm the study result, Mann-Whitney U, a non-parametric test, was conducted for the groups with the variable shown a significant difference.

Further Analysis of the Effect of Independent Variable in Each Course

For further analysis of the main effects of the independent variables, three-way MANCOVA was conducted using type of course which participants had registered in. This analysis was conducted to examine if there were any significant difference in the different levels of mindfulness and knowledge about analogues within each course. Even though both the art course and the statistics course were non-majors, the goals of both courses were different. The goal of the art course was to learn the basic concepts in web-pages design and the goal of the statistics course was to understand the basic concepts of statistics. The former was more related to the content of the tutorial in this study than the latter. Therefore, the attitude of the participants from the art course toward the tutorial could influence more than the attitude of the participants from the statistics course did.

Descriptive Statistics

Descriptive statistics were run to describe frequencies and means of the groups divided by different levels of mindfulness and knowledge about analogues, and type of course.
Test of Assumptions

To investigate effect of mindfulness and knowledge about analogue in different courses on high-road and low-road transfers, three-way MANCOVA was used. To justify the use of MANCOVA, assumptions were tested.

Prior knowledge was used as a covariate to control the interference with the effect of independent variables. Using prior knowledge as a covariate was justified by the significant correlation between knowledge about analogue and prior knowledge in the early stage of the data analysis.

Multivariate analysis was used because low-road transfer and high-road transfer could influence to each other in web-page development as described earlier in the data analysis. Correlation and multicollinearity between high-road and low-road transfers justified the use of multivariate analysis earlier.

Homogeneity of groups was tested again based on the re-grouping, because the data were examined by three factors. To test homogeneity of covariance matrices among groups, Box’s test was conducted. To test homogeneity of variances among groups, Levene’s test was conducted.

Univariate normality of each dependent variable was checked using a z-score of skewness for the dependent variable earlier in the data analysis. If the assumption of normality was violated, Mann-Whitney U, a non-parametric test, was necessary to confirm the significant of the effect.
**Analysis of Variables**

Three-way MANCOVA was conducted to investigate the effect of mindfulness and knowledge about analogues on low-road transfer and high-road transfer, using prior knowledge as a covariate, for each course.

Three-way ANCOVA for each dependent variable was conducted as a follow-up analysis. Adjusted means and standard deviations were computed for the groups with the variables shown a significant difference by partiailling out the effect of the covariate. Based on the adjusted means, the analysis was followed by Bonferroni corrected post hoc comparisons to examine where the difference exists among groups, if required. The alpha level of significance for all hypothesis testing was set at the .05. To confirm the study result, Mann-Whitney U, a non-parametric test, was conducted for the groups with the variables shown a significant difference.

If there was an interaction between variables, adjusted means and standard deviations were computed for the groups with the variables shown an interaction by partialling out the effect of the covariate. The means were used to draw plot showing the interaction between variables.

**Relationship between High-road Transfer and Low-road Transfer**

In order to test the relationship between high-road transfer and low-road transfer, correlation between the two variables were tested.

- $H_{07}$. No significant correlation between high-road transfer and low-road transfer will be found.
- $H_{a7}$. There will be a significant correlation between high-road transfer and low-road transfer.
CHAPTER 4
STATISTICAL ANALYSIS AND RESULTS

Introduction

The purpose of this study was to investigate the effect of different levels of mindful abstraction activities and the different levels of knowledge about analogues on both high-road and low-road transfers, and to investigate the relationship between high-road and low-road transfer. Seven research questions have been devised and formulated into seven hypotheses. This chapter reports the results of the statistical analyses for each hypothesis.

Descriptive Statistics

Background Survey

An analysis of background survey data showed that approximately 98% of the participants had used word processing software for more than 3 years (See Table 11). All the participants responded that they felt using word processing software, was “Easy” or “Very Easy” (See Table 12).
Table 11. Word Processing Software Experience

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Less than 1 Year</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 Year or More but Less than 3 Years</td>
<td>4</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>3 Years or More but Less than 5 Years</td>
<td>34</td>
<td>18.7</td>
<td>18.7</td>
<td>20.9</td>
</tr>
<tr>
<td>More than 5 Years</td>
<td>144</td>
<td>79.1</td>
<td>79.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 12. Feeling about Using Word Processing Software

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Easy</td>
<td>114</td>
<td>62.6</td>
<td>62.6</td>
<td>62.6</td>
</tr>
<tr>
<td>Easy</td>
<td>68</td>
<td>37.4</td>
<td>37.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Difficult</td>
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<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Very Difficult</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

More than half of the participants had no experience in web-page development. Fifty six percent of the participants answered that they have no experience with web-page development using authoring tools (See Table 13). Sixty two percent of the participants answered that they have not used a markup language such as HTML and CSS before (See Table 14).

Table 13. Authoring Tool Experience

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>102</td>
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<td>56.0</td>
<td>56.0</td>
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<tr>
<td>Less than 1 Year</td>
<td>37</td>
<td>20.3</td>
<td>20.3</td>
<td>76.4</td>
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<tr>
<td>1 Year or More but Less than 3 Years</td>
<td>30</td>
<td>16.5</td>
<td>16.5</td>
<td>92.9</td>
</tr>
<tr>
<td>3 Years or More but Less than 5 Years</td>
<td>9</td>
<td>4.9</td>
<td>4.9</td>
<td>97.8</td>
</tr>
<tr>
<td>More than 5 Years</td>
<td>4</td>
<td>2.2</td>
<td>2.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 14. Markup Language Experience

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>112</td>
<td>61.5</td>
<td>61.5</td>
<td>61.5</td>
</tr>
<tr>
<td>Less than 1 Year</td>
<td>41</td>
<td>22.5</td>
<td>22.5</td>
<td>84.1</td>
</tr>
<tr>
<td>1 Year or More but Less than 3 Years</td>
<td>16</td>
<td>8.8</td>
<td>8.8</td>
<td>92.9</td>
</tr>
<tr>
<td>3 Years or More but Less than 5 Years</td>
<td>4</td>
<td>2.2</td>
<td>2.2</td>
<td>95.1</td>
</tr>
<tr>
<td>More than 5 Years</td>
<td>9</td>
<td>4.9</td>
<td>4.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Even though approximately 80% of participants had none or less than a year of experience in web-page development, almost all of the participants answered that they felt that developing web-page using markup language was “easy” or “very easy” (See Table 15).

Table 15. Feeling about Using Markup Language

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Easy</td>
<td>32</td>
<td>17.6</td>
<td>17.6</td>
<td>17.6</td>
</tr>
<tr>
<td>Easy</td>
<td>147</td>
<td>80.8</td>
<td>80.8</td>
<td>98.4</td>
</tr>
<tr>
<td>Difficult</td>
<td>3</td>
<td>1.6</td>
<td>1.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Very Difficult</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

On the contrary, about 70% of the participants answered that they have difficulty using a computer in general (See Table 16), and about 65% answered that they used a computer only when required (See Table 17).

Table 16. Feeling about Using Computer in General

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Easy</td>
<td>14</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Easy</td>
<td>42</td>
<td>23.1</td>
<td>23.1</td>
<td>30.8</td>
</tr>
<tr>
<td>Difficult</td>
<td>97</td>
<td>53.3</td>
<td>53.3</td>
<td>84.1</td>
</tr>
<tr>
<td>Very Difficult</td>
<td>29</td>
<td>15.9</td>
<td>15.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 17. Occasion of Using Computer

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Anytime Possible</td>
<td>63</td>
<td>34.6</td>
<td>34.6</td>
<td>34.6</td>
</tr>
<tr>
<td>Use When Required</td>
<td>119</td>
<td>65.4</td>
<td>65.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Do Not Use If Possible</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Almost Never</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

The last three responses are inconsistent, since most of the participants answered that they did not feel at ease using computers and used one only for required occasions, while they felt it was easy to use markup language. This may imply that either they had a skewed perception about using markup language because of a lack of experience and knowledge, or they had high standards for using computers because of high expectations of society. However, the reason for this inconsistency is unknown based on this survey.

Knowledge about Analogues

The overall mean (M = 7.95) of knowledge about analogues test became the cut-off point for defining the level of knowledge about analogues. Based on the division, the participants with scores from zero to seven were identified as the low knowledge about analogues group, and the participants with scores from eight to 15 were identified as the high knowledge about analogues group. The sample size for the groups of low level of knowledge about analogues was 90 and the sample size for the group of high level of knowledge about analogues was 92. Based on those categorizing, numbers of participants for groups by levels of mindfulness and knowledge about analogues are shown in the Table 18.
Table 18. Number of Participants for Groups by Levels of Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th>Level of Mindfulness</th>
<th>Low</th>
<th>Semi-effortful</th>
<th>Effortful</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>27</td>
<td>32</td>
<td>33</td>
<td>92</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>62</td>
<td>63</td>
<td>182</td>
</tr>
</tbody>
</table>

The means and standard deviations of knowledge about analogues for groups by levels of mindfulness and knowledge about analogues are shown in Table 19. Knowledge about Analogues scores were not significantly different across the levels of mindfulness, F(2, 179) = 2.058, p = .131, partial $\eta^2 = .022$. Figure 19 shows a plot of the overall frequency distribution of knowledge about analogues.

Table 19. Means and Standard Deviations of Knowledge about Analogues for Groups by Levels of Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th>Level of Mindfulness</th>
<th>Effortless</th>
<th>Semi-effortful</th>
<th>Effortful</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Low</td>
<td>30</td>
<td>4.23</td>
<td>1.455</td>
<td>30</td>
</tr>
<tr>
<td>High</td>
<td>27</td>
<td>10.41</td>
<td>1.947</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>7.16</td>
<td>3.540</td>
<td>62</td>
</tr>
</tbody>
</table>

Note: Maximum possible score was 15.
Knowledge about Analogues

Prior Knowledge

The means and standard deviations of prior knowledge for groups by levels of mindfulness and knowledge about analogues are shown in Table 20 and a plot of overall frequency distribution of prior knowledge is shown in Figure 20. The possible score range was zero to 12 and the overall mean was 1.54. This mean score proves that participants were not knowledgeable in using HTML and CSS commands. Considering the very low mean scores for groups, the mean scores of prior knowledge for the groups with effortless and semi-effortful mindful abstraction activities in high level of knowledge about analogues were relatively high among groups. Also, the scores for all the groups with high level of knowledge about analogues were higher than the scores for all the groups with low level of knowledge about analogues. The difference among groups was taken into consideration by using prior knowledge as a covariate later in the analysis.
### Table 20. Means and Standard Deviations of Prior Knowledge for Groups by Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th>Level of Knowledge about Analogues</th>
<th>Level of Mindfulness</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effortless</td>
<td>Semi-effortful</td>
</tr>
<tr>
<td>Low</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>High</td>
<td>27</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>57</td>
<td>62</td>
</tr>
</tbody>
</table>

Note: Maximum possible score was 12.

**Low-road Transfer**

The means and standard deviations of low-road transfer for groups by levels of mindfulness and knowledge about analogues are shown in Table 21 and a plot of overall frequency distribution of low-road transfer is shown in Figure 21. The possible score ranged from zero to 15. The mean score of low-road transfer for the group of semi-effortful abstraction...
activities and high level of knowledge about analogues was the highest score among all six groups.

Table 21. Means and Standard Deviations of Low-road Transfer for Groups by Levels of Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th>Level of Mindfulness</th>
<th>Total</th>
<th>Effortless</th>
<th>Semi-effortful</th>
<th>Effortful</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>Low</td>
<td>30</td>
<td>6.47</td>
<td>2.980</td>
<td>30</td>
<td>6.83</td>
<td>2.422</td>
<td>30</td>
</tr>
<tr>
<td>High</td>
<td>27</td>
<td>7.11</td>
<td>2.044</td>
<td>32</td>
<td>8.16</td>
<td>3.919</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>57</td>
<td>6.77</td>
<td>2.577</td>
<td>62</td>
<td>7.52</td>
<td>3.323</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>7.65</td>
<td>3.069</td>
<td>182</td>
<td>7.27</td>
<td>2.975</td>
<td></td>
</tr>
</tbody>
</table>

Note: Maximum possible score was 15.

Figure 21. Overall Frequency Distribution of Low-road Transfer

High-road Transfer

The means and standard deviations of high-road transfer for groups by levels of mindfulness and knowledge about analogues are shown in Table 22 and a plot of overall
frequency distribution of high-road transfer is shown in Figure 22. The possible score ranged from zero to 16. The mean score of high-road transfer for the group of semi-effortful mindfulness with high level of knowledge about analogues was the highest score among all six groups, same as in low-road transfer. Most of the scores of high-road transfer were relatively low, so the distribution of high-road transfer was positively skewed (See Figure 22).

Table 22. Means and Standard Deviations of High-road Transfer for Groups by Levels of Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th>Level of Mindfulness</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effortless</td>
<td></td>
</tr>
<tr>
<td>Semi-effortful</td>
<td></td>
</tr>
<tr>
<td>Effortful</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>30</td>
<td>1.97</td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>27</td>
<td>2.22</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>57</td>
<td>2.09</td>
</tr>
</tbody>
</table>

Note: Maximum possible score was 16.

Note: Maximum possible score was 16.

Figure 22. Overall Frequency Distribution of High-road Transfer
Effect of Mindfulness and Knowledge about Analogues on High-road and Low-road Transfer

Two-way MANCOVA was used to investigate the effect of mindfulness and knowledge about analogues on high-road and low-road transfer to answer the hypotheses below.

H\textsubscript{01}. No significant difference will be found among groups with different levels of mindful abstraction activities in high-road transfer.

H\textsubscript{a1-1}. The group with highest level of mindful abstraction activities, as represented by effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

H\textsubscript{a1-2}. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

H\textsubscript{02}. No significant difference will be found among groups of different levels of mindful abstraction activities in low-road transfer.

H\textsubscript{03}. No significant difference will be found between groups of different levels of knowledge about analogues in high-road transfer.

H\textsubscript{a3}. The group with high knowledge about analogues will show high-road transfer significantly greater than the group with low knowledge about analogues.
H04. No significant difference will be found between groups of different levels of knowledge about analogues in low-road transfer.

H05. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in high-road transfer.

Hₐ5-1. The group with the highest level of mindful abstraction activities, as represented by effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

Hₐ5-2. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

H06. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in low-road transfer.

Test of Assumptions

Use of Prior Knowledge as a Covariate

To examine the systematical variations of prior knowledge and knowledge about analogues, correlation was run. Table 23 shows the correlation between prior knowledge and knowledge about analogues. The correlation between knowledge about analogues and prior
knowledge was ($r_s = .186, N=182, p < .05, \text{two-tailed}$). This value indicated that prior knowledge varies systematically with knowledge about analogues.

Table 23. Correlation between Knowledge about Analogues and Prior Knowledge

<table>
<thead>
<tr>
<th></th>
<th>Knowledge about Analogues</th>
<th>Prior Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman's rho</td>
<td>Correlation Coefficient 1.000</td>
<td>.186 *</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed) .</td>
<td>.012</td>
</tr>
<tr>
<td></td>
<td>N 182</td>
<td>182</td>
</tr>
<tr>
<td>Prior Knowledge</td>
<td>Correlation Coefficient .186 * 1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed) .012</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>N 182</td>
<td>182</td>
</tr>
</tbody>
</table>

* $p < .05, \text{2-tailed}$.

To examine differences of the mean scores of prior knowledge among groups, two-way ANOVA was run (See Table 24). Results showed that mean scores of prior knowledge were significantly different among different levels of mindfulness, $F(2, 176) = 4.519, p = .012$, partial $\eta^2 = .049$. The results also showed mean scores of prior knowledge were significantly different between levels of knowledge about analogues, $F(1, 176) = 17.206, p < .001$, partial $\eta^2 = .089$.

Table 24. Differences of Prior knowledge for Groups by Levels of Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindfulness</td>
<td>32.457</td>
<td>2</td>
<td>16.229</td>
<td>4.519*</td>
<td>.012</td>
<td>.049</td>
</tr>
<tr>
<td>Analogues</td>
<td>61.789</td>
<td>1</td>
<td>61.789</td>
<td>17.206*</td>
<td>.000</td>
<td>.089</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>1.477</td>
<td>2</td>
<td>.739</td>
<td>.206</td>
<td>.814</td>
<td>.002</td>
</tr>
<tr>
<td>* Analogues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>632.048</td>
<td>176</td>
<td>3.591</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1161.000</td>
<td>182</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>727.148</td>
<td>181</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05, \text{2-tailed}$.

The significant correlation justified the use of prior knowledge as a covariate.
Correlation between Low-road Transfer and High-road Transfer

The correlation between low-road transfer and high-road transfer is shown in Table 25. The correlation was tested to justify the use of multivariate analysis. The correlation between low-road transfer and high-road transfer was $r_s = .659$, $N=182$, $p < .05$, two-tailed. The significant correlation value was not greater than .90, which did not show multicollinearity (Brace et al., 2003). Therefore, the correlation between two dependent variables justified the use of multivariate analysis.

Table 25. Correlation between High-road Transfer and Low-road Transfer

<table>
<thead>
<tr>
<th></th>
<th>Low-road Transfer</th>
<th>High-road Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman's rho</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-road Transfer</td>
<td>Correlation Coefficient</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>182</td>
</tr>
<tr>
<td>High-road Transfer</td>
<td>Correlation Coefficient</td>
<td>.659 *</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>182</td>
</tr>
</tbody>
</table>

* $p < .05$, 2-tailed.

Homogeneity of Groups

Homogeneity of covariance matrices among groups was tested using Box’s test. Table 26 shows the covariance is equal among groups at the $p < .05$ level, thus, meeting the assumption of the homogeneity.

Table 26. Box's Test of Equality of Covariance Matrices among Groups by Mindfulness and Knowledge about Analogues

<table>
<thead>
<tr>
<th></th>
<th>Low-road Transfer</th>
<th>High-road Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box's M</td>
<td>23.767</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1.539</td>
<td></td>
</tr>
<tr>
<td>df1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>df2</td>
<td>161682.098</td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>.082</td>
<td></td>
</tr>
</tbody>
</table>
Homogeneity of variances among groups was tested using Levene’s test. The Levene’s test showed that the variances are equal among groups in high-road transfer but not in low-road transfer (See Table 27). According to Field (2005), when Levene’s test indicates a significant difference between variances, the test results can be double checked by the computation of the squared highest variance divided by the squared lowest variance (highest $SD^2$ ÷ lowest $SD^2$). A resulting value of less than two allows tenure of the assumption of homogeneity. Based on this calculation, the resulting value was 1.65, which is less than two. Therefore the assumption of homogeneity of variance was tenured.

Table 27. Levene’s Test of Equality of Error Variances

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-road Transfer</td>
<td>2.649</td>
<td>5</td>
<td>176</td>
<td>.025</td>
</tr>
<tr>
<td>High-road Transfer</td>
<td>1.037</td>
<td>5</td>
<td>176</td>
<td>.397</td>
</tr>
</tbody>
</table>

**Normality of Dependent Variables**

Normality of each dependent variable was examined using z-score of skewness. Z-score of skewness was converted by subtracting mean of distribution and dividing by the standard deviation of distribution, $Z_{skewness} = (Skewness – 0)/Standard Error of Skewness$ (Field, 2005). If the z-score is greater than 1.96, the dependent variable is not normally distributed at $p < .05$ level. Table 28 shows the skewness and converted z-score of each dependent variable. The z-score for low-road transfer confirmed normal distribution. However, the z-score for high-road transfer confirmed abnormality of distribution. As shown in Figure 22, the high-road transfer was positively skewed. This did not meet the assumption of normal distribution of dependent
variables for using MANCOVA, indicating that Mann-Whitney U would be needed if the
analysis showed a significant difference for high-road transfer.

Table 28. Tests of Normality

<table>
<thead>
<tr>
<th>Effect</th>
<th>Skewness</th>
<th>Std. Error of Skewness</th>
<th>Converted z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-road Transfer</td>
<td>.210</td>
<td>.180</td>
<td>1.167</td>
</tr>
<tr>
<td>High-road Transfer</td>
<td>.567</td>
<td>.180</td>
<td>3.150</td>
</tr>
</tbody>
</table>

Analysis of Variables

Multivariate Analysis

The multivariate table (See Table 29) shows a significant effect of the level of mindful
abstraction activities (effortless, semi-effortful, or effortful) on type of transfer, $F(2, 175) = 3.439, p = .034$; Roy’s Largest Root = .039; partial $\eta^2 = .038$. However, both knowledge about
analogues and the interaction between knowledge about analogues and mindful activities did not show significant affects.

Table 29. Multivariate Tests (Roy's Largest Root Test)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior Knowledge</td>
<td>.063</td>
<td>5.516*</td>
<td>2.000</td>
<td>174.000</td>
<td>.005</td>
<td>.060</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>.039</td>
<td>3.439*</td>
<td>2.000</td>
<td>175.000</td>
<td>.034</td>
<td>.038</td>
</tr>
<tr>
<td>Knowledge about Analogues</td>
<td>.010</td>
<td>.894</td>
<td>2.000</td>
<td>174.000</td>
<td>.411</td>
<td>.010</td>
</tr>
<tr>
<td>Interaction</td>
<td>.014</td>
<td>1.202</td>
<td>2.000</td>
<td>175.000</td>
<td>.303</td>
<td>.014</td>
</tr>
</tbody>
</table>

* p < .05, 2-tailed.

Univariate Analysis

Univariate analysis of each individual dependent variable was conducted as a follow-up analysis.
Analysis of each individual dependent variable showed a significant difference among groups with different levels of mindful abstraction activities for high-road transfer, $F(2, 175) = 3.430$, $p = .035$, partial $\eta^2 = .038$ (See Table 30).

Table 30. Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior Knowledge</td>
<td>Low-road Transfer</td>
<td>71.242</td>
<td>1</td>
<td>71.242</td>
<td>8.448*</td>
<td>.004</td>
<td>.046</td>
</tr>
<tr>
<td></td>
<td>High-road Transfer</td>
<td>38.653</td>
<td>1</td>
<td>38.653</td>
<td>9.563*</td>
<td>.002</td>
<td>.052</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>Low-road Transfer</td>
<td>20.941</td>
<td>2</td>
<td>10.470</td>
<td>1.242</td>
<td>.291</td>
<td>.014</td>
</tr>
<tr>
<td></td>
<td>High-road Transfer</td>
<td>27.731</td>
<td>2</td>
<td>13.865</td>
<td>3.430*</td>
<td>.035</td>
<td>.038</td>
</tr>
<tr>
<td>Knowledge about Analogues</td>
<td>Low-road Transfer</td>
<td>5.193</td>
<td>1</td>
<td>5.193</td>
<td>.616</td>
<td>.434</td>
<td>.004</td>
</tr>
<tr>
<td></td>
<td>High-road Transfer</td>
<td>7.249</td>
<td>1</td>
<td>7.249</td>
<td>1.793</td>
<td>.182</td>
<td>.010</td>
</tr>
<tr>
<td>Interaction</td>
<td>Low-road Transfer</td>
<td>11.383</td>
<td>2</td>
<td>5.692</td>
<td>.675</td>
<td>.511</td>
<td>.008</td>
</tr>
<tr>
<td></td>
<td>High-road Transfer</td>
<td>4.802</td>
<td>2</td>
<td>2.401</td>
<td>.594</td>
<td>.553</td>
<td>.007</td>
</tr>
<tr>
<td>Error</td>
<td>Low-road Transfer</td>
<td>1475.823</td>
<td>175</td>
<td>8.433</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>High-road Transfer</td>
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<td>175</td>
<td>4.042</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Low-road Transfer</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
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<td>High-road Transfer</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>Low-road Transfer</td>
<td>1601.808</td>
<td>181</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High-road Transfer</td>
<td>803.516</td>
<td>181</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05, 2-tailed.

Post Hoc Comparison

To investigate the difference among 3 levels of mindfulness further, adjusted means of the groups for high-road transfer were computed (See Table 31).

Table 31. Adjusted Means of High-road Transfer for Groups of Different Levels of Mindfulness

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Level of Mindfulness</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>High-road Transfer</td>
<td>Effortless</td>
<td>2.104</td>
<td>.267</td>
<td>1.578</td>
</tr>
<tr>
<td></td>
<td>Semi-effortful</td>
<td>2.840</td>
<td>.259</td>
<td>2.329</td>
</tr>
<tr>
<td></td>
<td>Effortful</td>
<td>3.021</td>
<td>.257</td>
<td>2.515</td>
</tr>
</tbody>
</table>

*a Evaluated at covariates appeared in the model: Prior Knowledge = 1.54.
Based on those adjusted means, Bonferroni corrected post hoc comparisons among the different levels of mindfulness in high-road transfer followed (See Table 32). The analysis showed a significant difference between the group of effortless activities and the group of effortful activities at the p < .05 level.

Table 32. Pairwise Comparisons among Groups of Different Levels of Mindfulness in High-road Transfer

<table>
<thead>
<tr>
<th>(I) Level of Mindfulness</th>
<th>(J) Level of Mindfulness</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.*</th>
<th>95% Confidence Interval for Difference a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Effortless</td>
<td>Semi-effortful</td>
<td>-.727</td>
<td>.372</td>
<td>.157</td>
<td>-1.626</td>
</tr>
<tr>
<td>Effortful</td>
<td></td>
<td>-.943 *</td>
<td>.369</td>
<td>.034</td>
<td>-1.834</td>
</tr>
<tr>
<td>Semi-effortful</td>
<td>Effortless</td>
<td>.727</td>
<td>.372</td>
<td>.157</td>
<td>-.172</td>
</tr>
<tr>
<td>Effortful</td>
<td>Effortless</td>
<td>-.216</td>
<td>.368</td>
<td>1.000</td>
<td>-1.105</td>
</tr>
<tr>
<td>Effortful</td>
<td>Semi-effortful</td>
<td>.943 *</td>
<td>.369</td>
<td>.034</td>
<td>5.148E-02</td>
</tr>
</tbody>
</table>

Based on Adjusted Means
* p < .05, 2-tailed.
a Adjustment for multiple comparisons: Bonferroni.

Non-Parametric Test

As for a non-parametric test, Mann-Whitney U for comparison between the effortless group and the effortful group was conducted to confirm the effect of mindfulness among groups in high-road transfer. Table 33 shows the result of the test and the effortless group and the effortful group shows significant difference in this test also. The group of effortful mindful activities performed significantly better than the group of effortless mindful activities (U=1382.000, N₁ = 57, N₂ = 63, p = .028, two-tailed). The test result confirms again the main effect of mindfulness on high-road transfer.
Table 33. Mann Whitney U Test for Comparison between the Effortless Level Group and the Effortful Level Group

<table>
<thead>
<tr>
<th></th>
<th>High-road Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann-Whitney U</td>
<td>1382.000</td>
</tr>
<tr>
<td>Wilcoxon W</td>
<td>3035.000</td>
</tr>
<tr>
<td>Z</td>
<td>-2.204</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.028</td>
</tr>
</tbody>
</table>

*a* Grouping Variable: Level of Mindful Abstraction Activities

Based on the analysis, hypotheses were evaluated as below;

<table>
<thead>
<tr>
<th>H₀₁</th>
<th>No significant difference will be found among groups with different levels of mindful abstraction activities in high-road transfer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hₐ₁−₁</td>
<td>The group with highest level of mindful abstraction activities, as represented by effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.</td>
</tr>
<tr>
<td>Hₐ₁−₂</td>
<td>The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.</td>
</tr>
</tbody>
</table>

MANCOVA showed a significant effect of mindfulness, F(2, 175) = 3.439, p = .034; Roy’s Largest Root = .039; partial $\eta^2 = .038$ (See Table 29). Univariate analysis showed a significant effect of mindfulness in high-road transfer, F(2, 175) = 3.43, p = .035, partial $\eta^2 = .038$ (See Table 30). Based on adjusted mean scores, Bonferroni corrected post hoc comparisons showed that the group with effortful mindful activities was significantly better than
the group with effortless mindful activities in high-road transfer (See Table 32). Therefore the null hypothesis, \( H_{01} \), was rejected. The first alternative hypothesis, \( H_{a1-1} \), was supported but the second alternative hypothesis, \( H_{a1-2} \), was not supported.

\[
H_{02}. \text{ No significant difference will be found among groups of different levels of mindful abstraction activities in low-road transfer.}
\]

MANCOVA showed a significant effect of mindfulness, \( F(2, 175) = 3.43, p = .034; \) Roy’s Largest Root = .039; partial \( \eta^2 = .038 \) (See Table 29). However, univariate analysis showed no significant effect of mindfulness in low-road transfer, \( F(2, 175) = 1.242, p = .291, \) partial \( \eta^2 = .014 \) (See Table 30). Therefore the null hypothesis, \( H_{02} \), was retained.

\[
H_{03}. \text{ No significant difference will be found between groups of different levels of knowledge about analogues in high-road transfer.}
\]

\[
H_{a3}. \text{ The group with high knowledge about analogues will show high-road transfer significantly greater than the group with low knowledge about analogues.}
\]

MANCOVA showed no significant effect of knowledge about analogues, \( F(2, 174) = .894, p = .411; \) Roy’s Largest Root = .010; partial \( \eta^2 = .010 \) (See Table 29). Also, univariate analysis showed no significant effect of knowledge about analogues in high-road transfer, \( F(1, 175) = 1.793, p = .182, \) partial \( \eta^2 = .010 \) (See Table 30). Therefore the null hypothesis, \( H_{03} \), was retained and alternative hypothesis, \( H_{a3} \), was not supported.
H₀⁴. No significant difference will be found between groups of different levels of knowledge about analogues in low-road transfer.

MANCOVA showed no significant effect of knowledge about analogues, $F(2, 174) = .894, p = .411$; Roy’s Largest Root = .010; partial $\eta^2 = .010$ (See Table 29). Also, univariate analysis showed no significant effect of knowledge about analogues in low-road transfer, $F(1, 175) = .616, p = .434$, partial $\eta^2 = .004$ (See Table 30). Therefore the null hypothesis, H₀⁴, was retained.

H₀⁵. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in high-road transfer.

Hₐ₅-1. The group with the highest level of mindful abstraction activities, as represented by effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

Hₐ₅-2. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

MANCOVA showed no significant interaction between mindfulness and knowledge about analogues, $F(2, 175) = 1.202, p = .303$; Roy’s Largest Root = .014; partial $\eta^2 = .014$ (See Table 29). Also, univariate analysis showed no significant effect of mindfulness in high-road
transfer, $F(2, 175) = .594$, $p = .553$, partial $\eta^2 = .007$. Therefore the null hypothesis, $H_{05}$, was retained and neither alternative hypotheses, $H_{a5-1}$ and $H_{a5-2}$, were not supported (See Table 30).

$H_{06}$. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in low-road transfer.

MANCOVA showed no significant interaction between mindfulness and knowledge about analogues, $F(2, 175) = 1.202$, $p = .303$; Roy’s Largest Root = .014; partial $\eta^2 = .014$ (See Table 29). Also, univariate analysis showed no significant effect of mindfulness in low-road transfer, $F(2, 175) = .675$, $p = .511$, partial $\eta^2 = .008$ (See Table 30). Therefore the null hypothesis, $H_{06}$, was retained.

Further Analysis of the Effect of Independent Variables in Each Course

For further analysis of the main effects of the independent variables, three-way MANCOVA was conducted using types of course which participants had registered in. This analysis was conducted to examine if there were any significant difference in the effects of two main independent variables in each course or interaction between the courses.

Descriptive Statistics

Descriptive statistics were run to describe frequencies and means of the groups divided by different levels of three variables. Table 34 and Table 35 show the means, standard deviations for each group of mindfulness, knowledge about analogues, and course in both types of transfer.
Table 34. Means and Standard Deviations of Low-road Transfer for Groups by Mindfulness, Knowledge about Analogues, and Course

<table>
<thead>
<tr>
<th>Level of Mindful Activities</th>
<th>Level of Knowledge about Analogues</th>
<th>Course</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effortless</td>
<td>Low</td>
<td>STAT</td>
<td>6.62</td>
<td>2.941</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>ART</td>
<td>6.11</td>
<td>3.219</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6.47</td>
<td>2.980</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>STAT</td>
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<td>1.168</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>ART</td>
<td>7.06</td>
<td>2.516</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td>2.044</td>
<td></td>
<td>27</td>
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<tr>
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<td>Total</td>
<td>STAT</td>
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<td>Total</td>
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<td>57</td>
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<td>1.667</td>
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<td>Total</td>
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<td>Total</td>
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<td>3.573</td>
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</tbody>
</table>
Table 35. Means and Standard Deviations of High-road Transfer for Groups by Mindfulness, Knowledge about Analogues, and Course

<table>
<thead>
<tr>
<th>Level of Mindful Activities</th>
<th>Level of Knowledge about Analogues</th>
<th>Course</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
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<td>1.323</td>
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<td></td>
<td>Total</td>
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<td>1.732</td>
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<td>30</td>
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<td>Low</td>
<td>STAT</td>
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<td>ART</td>
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<td>2.102</td>
<td></td>
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<tr>
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<td>2.30</td>
<td>2.058</td>
<td></td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>STAT</td>
<td>2.63</td>
<td>2.026</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>ART</td>
<td>3.48</td>
<td>2.105</td>
<td></td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.05</td>
<td>2.098</td>
<td></td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>STAT</td>
<td>2.50</td>
<td>2.028</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>ART</td>
<td>2.90</td>
<td>2.194</td>
<td></td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.68</td>
<td>2.107</td>
<td></td>
<td>182</td>
</tr>
</tbody>
</table>

Test of Assumptions

To investigate the effect of mindfulness and knowledge about analogue in different courses on high-road and low-road transfers, three-way MANCOVA was used. Some of the
assumptions were already tested and justified. Prior knowledge was used as a covariate to control
the interference to the effect of independent variables (See Table 23). Use of multivariate
analysis was justified by examination of correlation between low-road transfer and high-road
transfer (See Table 25). Also, normality of distribution of each dependent variable indicated that
a significant difference for high-road transfer should be confirmed with Mann-Whitney U (See
Table 28).

Homogeneities of groups were tested again based on the re-grouping, because data was
examined by three factors.

To test homogeneity of covariance matrices among groups, Box’s test was conducted. Table 36 shows the homogeneity of covariance among groups. Therefore, the test result
satisfies an assumption for using MANCOVA.

Table 36. Box’s Test of Equality of Covariance Matrices

<table>
<thead>
<tr>
<th></th>
<th>Box's M</th>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38.585</td>
<td>1.098</td>
<td>33</td>
<td>33732.459</td>
<td>.320</td>
</tr>
</tbody>
</table>

To test homogeneity of variances among groups, Levene’s test was conducted. The
Levene’s Test showed that the variance is equal across groups, which satisfies the assumption for
using ANCOVA (See Table 37).

Table 37. Levene's Test of Equality of Error Variances

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-road Transfer</td>
<td>1.800</td>
<td>11</td>
<td>170</td>
<td>.057</td>
</tr>
<tr>
<td>High-road Transfer</td>
<td>.423</td>
<td>11</td>
<td>170</td>
<td>.944</td>
</tr>
</tbody>
</table>
**Analysis of Variables**

Three-way MANCOVA was conducted to investigate the effect of mindfulness and knowledge about analogues on low-road transfer and high-road transfer, using prior knowledge as a covariate, for each course.

**Multivariate Analysis**

The multivariate analysis shows that there was a significant effect of the level of mindful abstraction activities (effortless, semi-effortful, or effortful) on the combined dependent variable, types of transfer, $F(2, 169) = 4.788, p = .009$; Roy’s Largest Root = .057; partial $\eta^2 = .054$ (See Table 38). The types of course showed significant differences, $F(2, 168) = 3.455, p = .034$; Roy’s Largest Root = .041; partial $\eta^2 = .040$ as well. Also, there is an interaction between the level of mindfulness and course, $F(2, 169) = 3.372, p = .037$; Roy’s Largest Root = .040; partial $\eta^2 = .038$.

Table 38. Multivariate Test Table using Roy's Largest Root

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Covariate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior Knowledge</td>
<td>.049</td>
<td>4.103*</td>
<td>2.000</td>
<td>168.000</td>
<td>.018</td>
<td>.047</td>
</tr>
<tr>
<td><strong>Main Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mindfulness</td>
<td>.057</td>
<td>4.788*</td>
<td>2.000</td>
<td>169.000</td>
<td>.009</td>
<td>.054</td>
</tr>
<tr>
<td>Analogue</td>
<td>.014</td>
<td>1.177</td>
<td>2.000</td>
<td>168.000</td>
<td>.311</td>
<td>.014</td>
</tr>
<tr>
<td>Course</td>
<td>.041</td>
<td>3.455*</td>
<td>2.000</td>
<td>168.000</td>
<td>.034</td>
<td>.040</td>
</tr>
<tr>
<td><strong>Two-way Interaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mindfulness * Analogue</td>
<td>.008</td>
<td>.703</td>
<td>2.000</td>
<td>169.000</td>
<td>.497</td>
<td>.008</td>
</tr>
<tr>
<td>Mindfulness * Course</td>
<td>.040</td>
<td>3.372*</td>
<td>2.000</td>
<td>169.000</td>
<td>.037</td>
<td>.038</td>
</tr>
<tr>
<td>Analogue * Course</td>
<td>.023</td>
<td>1.969</td>
<td>2.000</td>
<td>168.000</td>
<td>.143</td>
<td>.023</td>
</tr>
<tr>
<td><strong>Three-way Interaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mindfulness * Analogue * Course</td>
<td>.032</td>
<td>2.713</td>
<td>2.000</td>
<td>169.000</td>
<td>.069</td>
<td>.031</td>
</tr>
</tbody>
</table>

* $p < .05$, 2-tailed.
Univariate Analysis

Univariate analysis was conducted for each dependent variable as a follow-up analysis. Univariate analysis showed a significant difference among the group with different level of mindful abstraction activities in high-road transfer, $F(2, 169) = 4.778, p = .010$, partial $\eta^2 = .054$, and the course in low-road transfer $F(1, 169) = 5.642, p = .019$, partial $\eta^2 = .032$ (See Table 39). Also, there was a interaction between mindfulness and type of course in low-road transfer, $F(2, 169) = 3.308, p = .039$, partial $\eta^2 = .038$.

Table 39. Univariate Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
<td>Prior Knowledge</td>
<td>Low-road Transfer</td>
<td>44.216</td>
<td>1</td>
<td>44.216</td>
<td>5.663*</td>
<td>.018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>29.531</td>
<td>1</td>
<td>29.531</td>
<td>7.505*</td>
<td>.007</td>
</tr>
<tr>
<td>Main Effects</td>
<td>Mindfulness</td>
<td>Low-road Transfer</td>
<td>29.831</td>
<td>2</td>
<td>14.915</td>
<td>1.910</td>
<td>.151</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>37.602</td>
<td>2</td>
<td>18.801</td>
<td>4.778*</td>
<td>.010</td>
</tr>
<tr>
<td></td>
<td>Analogue</td>
<td>Low-road Transfer</td>
<td>6.065</td>
<td>1</td>
<td>6.065</td>
<td>.777</td>
<td>.379</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>9.285</td>
<td>1</td>
<td>9.285</td>
<td>2.360</td>
<td>.126</td>
</tr>
<tr>
<td></td>
<td>Course</td>
<td>Low-road Transfer</td>
<td>44.053</td>
<td>1</td>
<td>44.053</td>
<td>5.642*</td>
<td>.019</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>1.318</td>
<td>1</td>
<td>1.318</td>
<td>.335</td>
<td>.564</td>
</tr>
<tr>
<td>Two-way Interaction</td>
<td>Mindfulness * Analogue</td>
<td>Low-road Transfer</td>
<td>4.558</td>
<td>2</td>
<td>2.279</td>
<td>.292</td>
<td>.747</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>1.345</td>
<td>2</td>
<td>.672</td>
<td>.171</td>
<td>.843</td>
</tr>
<tr>
<td></td>
<td>Mindfulness * Course</td>
<td>Low-road Transfer</td>
<td>51.658</td>
<td>2</td>
<td>25.829</td>
<td>3.308*</td>
<td>.039</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>6.853</td>
<td>2</td>
<td>3.427</td>
<td>.871</td>
<td>.420</td>
</tr>
<tr>
<td></td>
<td>Analogue * Course</td>
<td>Low-road Transfer</td>
<td>8.844</td>
<td>1</td>
<td>8.844</td>
<td>1.133</td>
<td>.289</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>15.413</td>
<td>1</td>
<td>15.413</td>
<td>3.917</td>
<td>.051</td>
</tr>
<tr>
<td>Three-way Interaction</td>
<td>Mindfulness * Analogue * Course</td>
<td>Low-road Transfer</td>
<td>41.861</td>
<td>2</td>
<td>20.931</td>
<td>2.681</td>
<td>.071</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>19.258</td>
<td>2</td>
<td>9.629</td>
<td>2.447</td>
<td>.090</td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>Low-road Transfer</td>
<td>1319.444</td>
<td>169</td>
<td>7.807</td>
<td>2.447</td>
<td>.090</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>665.026</td>
<td>169</td>
<td>3.935</td>
<td>2.447</td>
<td>.090</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Low-road Transfer</td>
<td>11219.000</td>
<td>182</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-road Transfer</td>
<td>2112.000</td>
<td>182</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$, 2-tailed.
**Post Hoc Comparison**

To compare the groups with the different level of mindfulness abstraction activities, adjusted means of the groups in high-road transfer were computed (See Table 40).

Table 40. Adjusted Mean of High-road Transfer for Groups by Mindfulness, Knowledge about Analogues, and Course

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Level of Mindful Activities</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval Lower Bound</th>
<th>95% Confidence Interval Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-road Transfer</td>
<td>Effortless</td>
<td>1.913</td>
<td>.277</td>
<td>1.366</td>
<td>2.460</td>
</tr>
<tr>
<td></td>
<td>Semi-effortful</td>
<td>2.766</td>
<td>.258</td>
<td>2.257</td>
<td>3.275</td>
</tr>
<tr>
<td></td>
<td>Effortful</td>
<td>3.049</td>
<td>.261</td>
<td>2.533</td>
<td>3.564</td>
</tr>
</tbody>
</table>

*a* Evaluated at covariates appeared in the model: Prior Knowledge = 1.54.

Based on those adjusted means, Bonferroni corrected post hoc comparisons among the different levels of mindfulness in high-road transfer were followed (See Table 41). The analysis showed a significant difference between the group of effortless mindful activities and the group of effortful mindful activities at p < .05 level.

Table 41. Bonferroni Corrected Pairwise Comparisons of High-road Transfer among Groups with Different Level of Mindfulness

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) Level of Mindful Activities</th>
<th>(J) Level of Mindful Activities</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval for Difference</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-road Transfer</td>
<td>Effortless</td>
<td>Semi-effortful</td>
<td>-.853</td>
<td>.379</td>
<td>.077</td>
<td>-1.769</td>
<td>-2.056</td>
<td>-.215</td>
</tr>
<tr>
<td></td>
<td>Effortful</td>
<td>Effortful</td>
<td>-1.136 *</td>
<td>.381</td>
<td>.010</td>
<td>-2.056</td>
<td>-2.215</td>
<td>-2.15</td>
</tr>
<tr>
<td>Semi-effortful</td>
<td>Effortless</td>
<td>Effortful</td>
<td>.853</td>
<td>.379</td>
<td>.077</td>
<td>-2.056</td>
<td>-6.268E-02</td>
<td>1.769</td>
</tr>
<tr>
<td></td>
<td>Effortful</td>
<td>Effortful</td>
<td>-.283</td>
<td>.371</td>
<td>1.000</td>
<td>-1.179</td>
<td>-.614</td>
<td>1.179</td>
</tr>
<tr>
<td>Effortful</td>
<td>Effortless</td>
<td>Effortful</td>
<td>1.136 *</td>
<td>.381</td>
<td>.010</td>
<td>-.215</td>
<td>2.056</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semi-effortful</td>
<td>Effortful</td>
<td>.283</td>
<td>.371</td>
<td>1.000</td>
<td>-.614</td>
<td>1.179</td>
<td></td>
</tr>
</tbody>
</table>

* * p < .05, 2-tailed.
Non-Parametric Test

The difference between the group with effortless mindful abstraction activities and the groups with effortful mindful abstraction activities in high-road transfer had already been confirmed by Mann-Whitney U early in the data analysis (See Table 33). The group of effortful mindful activities performed better than the group of effortless mindful activities ($U=1382.000$, $N_1 = 57$, $N_2 = 63$, $p = .028$, two-tailed). The test result confirms again the main effect of mindfulness on high-road transfer.

Interaction between Mindfulness and Type of Course

Univariate analysis showed a significant interaction between types of course and levels of mindfulness in low-road transfer $F(2, 169) = 3.308$, $p = .039$, partial $\eta^2 = .038$ (See Table 39). Table 42 shows adjusted means of low-road transfer for groups by levels of mindfulness and types of course.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Level of Mindful Activities</th>
<th>Course</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effortless</td>
<td>STAT</td>
<td>7.012</td>
<td>.501</td>
<td>6.023</td>
<td>8.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ART</td>
<td>6.518</td>
<td>.566</td>
<td>5.401</td>
<td>7.634</td>
</tr>
<tr>
<td></td>
<td>Semi-effortful</td>
<td>STAT</td>
<td>6.315</td>
<td>.513</td>
<td>5.302</td>
<td>7.328</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ART</td>
<td>8.300</td>
<td>.506</td>
<td>7.301</td>
<td>9.299</td>
</tr>
<tr>
<td></td>
<td>Effortful</td>
<td>STAT</td>
<td>6.948</td>
<td>.454</td>
<td>6.052</td>
<td>7.844</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ART</td>
<td>8.735</td>
<td>.575</td>
<td>7.601</td>
<td>9.869</td>
</tr>
</tbody>
</table>

The interaction between the groups in low-road transfer based on the adjusted means is shown in Figure 23.
Figure 23. The Interaction between the Level of Mindfulness and Course in Low-road Transfer

According to the Figure 23, difference of low-road transfer among levels of mindfulness for the groups from the art course is greater than the groups from the statistics course. In other words, the groups from the art course were influenced by different levels of mindfulness abstraction activities in low-road transfer more than the groups from the statistics course did. Effortless abstraction activities showed less difference between the types of courses than the other two types of abstraction activities did.
Analysis of the Relationship between the Two Dependent Variables

To investigate the seventh hypothesis, the correlation was computed initially and a significant correlation between the two dependent variables ($r_s = .186$, $N=182$, $p < .01$, two-tailed) was observed (See Table 25).

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results of Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_07$. No significant correlation between high-road transfer and low-road transfer will be found.</td>
<td>Null hypothesis is rejected.</td>
</tr>
<tr>
<td>$H_{a7}$. There will be a significant correlation between high-road transfer and low-road transfer.</td>
<td>The first alternative hypothesis is supported.</td>
</tr>
</tbody>
</table>

Therefore the null hypothesis, $H_07$, was rejected and alternative hypothesis, $H_{a7}$, was supported.

Summary

Seven questions were posed and seven hypotheses formulated to investigate the effect of different levels of mindful abstraction activities on both high-road and low-road transfer, and the relationship between knowledge about analogues and both high-road and low-road transfer. Table 43 provides a summary of the results of this study.

Table 43. Summary of the Results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results of Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_{01}$. No significant difference will be found among groups with different levels of mindful abstraction activities in high-road transfer.</td>
<td>Null hypothesis is rejected.</td>
</tr>
<tr>
<td>$H_{a1-1}$. The group with highest level of mindful abstraction</td>
<td>The first alternative hypothesis is supported.</td>
</tr>
</tbody>
</table>
activities, as represented by effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

$H_{a1-2}$. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, will show high-road transfer significantly greater than the group with the lowest level of mindful abstraction activities, as represented by effortless mindfulness.

$H_{02}$. No significant difference will be found among groups of different levels of mindful abstraction activities in low-road transfer.

$H_{03}$. No significant difference will be found between groups of different levels of knowledge about analogues in high-road transfer.

$H_{a3}$. The group with high knowledge about analogues will show high-road transfer significantly greater than the group with low knowledge about analogues.

$H_{04}$. No significant difference will be found between groups of different levels of knowledge about analogues in low-road transfer.

$H_{05}$. No significant interaction will be found between different level of mindful abstraction activities and different level knowledge about analogues in high-road transfer.

$H_{a5-1}$. The group with the highest level of mindful abstraction activities, as represented by effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

$H_{a5-2}$. The group with middle level of mindful abstraction activities, as represented by semi-effortful mindfulness, and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.

$H_{06}$. No significant interaction will be found between different level of mindful abstraction activities and Null hypothesis is retained.
different level knowledge about analogues in low-road transfer.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results of Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₀₇. No significant correlation between high-road transfer and low-road transfer will be found.</td>
<td>Null hypothesis is rejected. Alternative hypothesis is supported.</td>
</tr>
<tr>
<td>H₉₇. There will be a significant correlation between high-road transfer and low-road transfer.</td>
<td></td>
</tr>
</tbody>
</table>

Post Hoc Findings

Further analysis was conducted to investigate the effect of different levels of mindful abstraction activities on both high-road and low-road transfer within each course. Table 44 provides a summary of the results of the analysis.

Table 44. Summary of the Further Analysis Results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results of Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₀₈. No significant difference will be found between types of course in high-road transfer.</td>
<td>Null hypothesis is retained. The alternative hypothesis is not supported.</td>
</tr>
<tr>
<td>H₉₈. The group from the art course will show high-road transfer significantly greater than the group from the statistics course.</td>
<td></td>
</tr>
<tr>
<td>H₀₉. No significant difference will be found between types of course in low-road transfer.</td>
<td>Null hypothesis is rejected. The alternative hypothesis is supported.</td>
</tr>
<tr>
<td>H₉₉. The group from the art course will show low-road transfer significantly greater than the group from the statistics course.</td>
<td></td>
</tr>
<tr>
<td>H₀₁₀. No significant interaction will be found between type of course and different level of mindful abstraction activities in high-road transfer.</td>
<td>Null hypothesis is retained. The alternative hypothesis is not supported.</td>
</tr>
<tr>
<td>H₉₁₀. The group from the art course with the highest level of mindful abstraction activities, as represented by effortful mindfulness will show high-road transfer</td>
<td></td>
</tr>
</tbody>
</table>
significantly greater than the other groups.

<table>
<thead>
<tr>
<th>Hypothesis (H0)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>H011. No significant interaction will be found between type of course and different level of mindful abstraction activities in low-road transfer.</td>
<td>Null hypothesis is rejected. The first alternative hypothesis is supported.</td>
</tr>
<tr>
<td>H11-1. The group from the art course with the highest level of mindful abstraction activities, as represented by effortful mindfulness will show low-road transfer significantly greater than the other groups.</td>
<td>Null hypothesis is retained. The second alternative hypothesis is supported.</td>
</tr>
<tr>
<td>H11-2. The group from the art course with the middle level of mindful abstraction activities, as represented by semi-effortful mindfulness will show low-road transfer significantly greater than the other groups.</td>
<td></td>
</tr>
<tr>
<td>H012. No significant interaction will be found between type of course and different level of knowledge about analogues in high-road transfer.</td>
<td>Null hypothesis is retained.</td>
</tr>
<tr>
<td>H013. No significant interaction will be found between type of course and different level of knowledge about analogues in low-road transfer.</td>
<td>Null hypothesis is retained.</td>
</tr>
<tr>
<td>H014. No significant interaction will be found among type of course, different level of mindful abstraction activities, and knowledge about analogues in high-road transfer.</td>
<td>Null hypothesis is retained. The alternative hypothesis is not supported.</td>
</tr>
<tr>
<td>H14. The group from the art course with the highest level of mindful abstraction activities and high level of knowledge about analogues will show high-road transfer significantly greater than the other groups.</td>
<td></td>
</tr>
<tr>
<td>H015. No significant interaction will be found among type of course, different level of mindful abstraction activities, and knowledge about analogues in low-road transfer.</td>
<td>Null hypothesis is retained.</td>
</tr>
</tbody>
</table>
CHAPTER 5
CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Introduction

The purpose of this study was to investigate the effect of different levels of mindful abstraction activities and the different levels of knowledge about analogues on both high-road and low-road transfer, and to investigate the relationship between high-road and low-road transfer.

Summary of Findings

This study posed seven questions: 1. Do different levels of mindful abstraction activities affect high-road transfer? 2. Do different levels of mindful abstraction activities affect low-road transfer? 3. Does knowledge about analogues affect high-road transfer? 4. Does knowledge about analogues affect low-road transfer? 5. Does an interaction occur between the levels of mindful abstraction activities and knowledge about analogues in high-road transfer? 6. Does an interaction occur between the levels of mindful abstraction activities and knowledge about analogues in low-road transfer? 7. Does any relationship exist between low-road transfer and high-road transfer?

According to the results, mindful abstraction activities were significantly more effective for high-road transfer. When participants practiced with effortful abstraction activities, rather than effortless abstraction activities (H_{a1-1}), high-road transfer was enhanced. However, the mindful abstraction activities did not show a significant difference among the groups in low-road
transfer (H_{02}). Knowledge about analogues caused no significant difference between the groups in both high-road transfer (H_{03}) and low-road transfer (H_{04}). No significant interaction was found between levels of mindful and level of knowledge about analogues for either high-road transfer (H_{05}) or low-road transfer (H_{06}). Finally low-road transfer and high-road transfer showed significant positive relationship (H_{a7}).

When further analysis took the type of course as the third factor into consideration, the groups from the art course showed low-road transfer significantly greater than the groups from the statistics course (H_{a9}). But there was no significant difference in high-road transfer for groups from difference courses (H_{08}). There was a significant interaction between level of mindfulness and type of course in low-road transfer (H_{a11-1} and H_{a11-2}). The groups from the art course were influenced significantly more than the groups from the statistics course by different levels of mindful abstraction activities in low-road transfer. Effortless abstraction activities showed less difference between the types of courses than the other two types of abstraction activities did.

Discussion of the Findings

Mindful Abstraction Activity and Transfer

Mindfulness is a mental status of conscious awareness for use of relevant information, which requires full attention and deliberate mental activities (Langer, 1978). In this study, different levels of mindful abstraction activities were used to generalize conceptual understanding of each HTML or CSS command. Abstracting similar commands from word processing software creates a bridge to learning HTML at a principles level. The three levels of mindfulness in this study required different levels of deliberate mental activities by providing
eight different abstraction activity tables. The study results of these different levels of abstraction activities provided the information for how differences in mindful abstraction activities affected each type of transfer.

**Mindfulness and High-road Transfer**

Mindful abstraction activities were more effective on high-road transfer when participants practiced with effortful abstraction activities than when they practiced with effortless abstraction activities. The analysis of the data showed that the group with effortful mindful activities \( M = 2.92, SD = 1.92 \) performed significantly better than the group with effortless mindful activities \( M = 2.09, SD = 1.73 \) in high-road transfer. Although the group with semi-effortful mindful activities that had highest mean score \( M = 2.98, SD = 2.48 \) among three groups, the adjusted means that took prior knowledge into consideration as a covariate demonstrated that the group with semi-effortful abstraction activities were not significantly different from the other groups (See Table 32).

The results imply that abstraction activities will be most effective to facilitate high-road transfer when the activities are practiced highly mindfully. Mindfulness is one of the conditions that Perkins and Salomon (1994) suggested in order for high-road transfer to occur. The study results support their suggestion and showed the importance of highest level of mindfulness.

Salomon and Perkins (1989) claim that learners need to “grasp the relationship” between abstracted principles and situations that reflect those principles, in order for high-road transfer to occur. This claim has two important links to this study. First, learners need to make connections between the abstraction and its instances. Second, the connecting process has to be fully understood by learners. In other words, the true meaning of understanding of the relationship can only happen when learners mentally engage their own understanding and efforts.
to make connections, rather than just comprehend predefined abstractions. The study results supported the claim.

In this study, effortless abstraction activity provided abstraction that was predefined by experts and instructional designers, which might have been more efficient and effective for more accurate learning and concise abstraction of knowledge. However, the accurate description of abstraction did not facilitate high-road transfer. The study results showed that learners perform significantly better on high-road transfer when they have attempted to analyze the instance cases and make connections between the new instance cases and the prior experiences to generalize abstraction with effortful mindfulness. This was true for semi-effortful abstraction activity, too. Even though participants had opportunities to generalize abstraction, the provided analogue situation, which was pre-defined and pre-analyzed by experts and instructional designer did not result in significantly higher performance on high-road transfer. This implies that the generalization of abstraction from the situation that is pre-defined and analyzed might have taken the opportunity away from learners to make meaningful connections between the abstraction and the situations. The study results support Bassok and Holyoak’s (1989) claim that learners need to be explicitly aware of the learned skills abstracted from their context in order to promote strong transfer.

**Mindfulness and Low-road Transfer**

The analysis results showed that the mindful abstraction activities did not reveal significant differences among the groups with different levels of mindfulness in low-road transfer (See Table 30).

Low-road transfer occurs when a new, given situation is sufficiently similar to draw automatized responses built by multiple practices in various contexts (Salomon & Perkins, 1989).
Low-road transfer depends more on a reflexive process triggered by the salient and familiar features rather than the abstraction underlying both new situations and prior experiences. Therefore, the mindful abstraction activity may not influence the low-road transfer directly. Mindful abstraction activities require learners to examine the generality between the new situation and prior experience, consciously, rather than to search for the salient similarity between the new situation and prior successful experience, reflexively.

Mindfulness and the Course Differences for Both Types of Transfer

When further analysis took the type of course as the third factor, an interaction was found between mindfulness and the type of course for low-road transfer, F(2, 169) = 3.308, p = .039, \( \eta^2 = .038 \), but not for high-road transfer F(2, 169) = .871, p = .420, \( \eta^2 = .010 \). Based on the adjusted means (See Table 42) and the plot (See Figure 23), the difference of low-road transfer among levels of mindfulness for the groups from the art course was greater than the groups from the statistics course. In other words, the groups from the art course were influenced by different levels of mindfulness abstraction activities in low-road transfer more than the groups from the statistics course did. Effortless abstraction activities showed less difference between the types of courses than the other two types of abstraction activities did.

Because of the goal of the art course was to develop web-pages, the participants from that course may have found more relevance from the tutorial. The content relevance may have influence to participants’ readiness to learn, motivation, or their mindfulness for abstraction more. Considering there was a significant effect of levels of mindfulness in high-road transfer in the main study but in low-road transfer, the course relevance may have blocked the effect of mindfulness in low-road transfer. If this is true, mindful abstraction activities facilitate not only high-road transfer but also low-road transfer too.
However, the clear differences between the participants from the art course and the
statistics course and the effect of their readiness are unknown based on this study.

Knowledge about Analogues and Transfer

Low and high knowledge about analogues performed similarly for both types of
transfer (See Table 30). When prior knowledge of HTML and CSS was taken into consideration
along with knowledge about analogues, the differences between high and low level of knowledge
about analogues became non-significant, although the group with high level of knowledge about
analogues performed better than the group with the low level of knowledge about analogues in
both low-road and high-road transfer (See Table 21 and Table 22).

Knowledge about analogues, in this case, the knowledge about using a word
documenting software is not directly related to the knowledge of web-page development. The
underlying principles between word documenting software and web-page development are very
similar. They use hierarchical text structured styling features, similar layout mechanisms of
margin and padding, and so on. However, the procedures for constructing an outcome, i.e. a page,
are very different. Because word documenting software is customized software for convenience,
many features that share the same principles are altered and hidden from the surface interface
level. Even though users use the same function as the web-page function, the underlying
reasoning of use can be quite different.

Unless learners realize the similarities and find active use of knowledge about
analogues for abstraction of general principles of other subject domains, knowledge about
analogues themselves would not affect transfer within other subject domains. One of the
difficulties of transfer is that humans seldom use knowledge in one domain that might help for
transfer in other domain intentionally and actively. Therefore, the natural conclusion is that no effect from knowledge about analogues would influence transfer. The mean score differences of both types of transfer between the group of low and high level of knowledge about analogues would have been caused by significantly different level of prior knowledge between the groups (See Table 24).

*Interaction between Mindfulness and Knowledge about Analogues in Transfer*

The interaction between mindfulness and knowledge about analogues showed no significant differences on both high-road and low-road transfer (See Table 30). The study results support the null hypothesis that no interaction would occur in both types of transfer. As the results about mindfulness showed, the key to successful high-road transfer is mindfulness not different levels of mindfulness for each level of knowledge about analogues.

However, the study results did not support the opinions from several researchers about knowledge about analogues. Gick and Holyoak (1980) claimed that analogues used for analogy should be comprehensible to learners because analogy requires better understating of the analogues to construct analogy when searching for similarities. Novick and Bassok (2005) also asserted the importance of general background knowledge that enables learners to use analogies. Chi, Bassok, Lewis, Reimann, and Glaser (1989) showed that higher levels of understanding about analogues influenced successful performance in novel situations, while lower levels of understanding about analogues hindered recognizing the structural similarities between the novel problems and prior learning.

Based on these notions, the group with high level of knowledge about analogues and the effortful mindful activities and semi-effortful mindful activities should have performed better
in high-road transfer than the other groups. However, no significant difference was found among groups by mindfulness and knowledge about analogues.

The study results imply that when the abstraction activities are highly mindful, level of knowledge about analogues of learners’ is not critical for successful high-road transfer.

Low-road Transfer and High-road Transfer

A significant correlation ($r_s = .659$, $N=182$, $p < .01$, two-tailed) existed between the high-road transfer and the low-road transfer.

According to Perkins and Salomon (1989) the mechanisms of both types of transfer are completely different. In fact, they occurred in opposite methods. Low-road transfer is attained throughout the extensive practice in various situations and the transfer became automatized with implicit understanding and skills. This implies that the greater the low-road transfer, the greater the understanding became implicit and automatized. On the other hand, high-road transfer is attained through the slow and deliberate manipulation of knowledge-searching for general similarities (Marini & Genereux, 1995). This requires conscious mental effort to search for one’s explicit knowledge base.

However, in order for transfer to occur, learners have to have a knowledge base either from which to show an automatized response or in which to search similarities. As Johnson-Laird (1983) argued, the better possibility of transferring a general rule to a new task or situation occurs, learners need a mental model related to the general rule. Therefore both types of transfer build a knowledge base, and based on the knowledge base learners can have a mental model.

In terms of knowledge attainment, low-road transfer is achieved relatively faster than high-road transfer. If a learner begins to build a knowledge base, low-road transfer would
support more than high-road transfer in the beginning. Therefore, the inference is that high level of low-road transfer would facilitate high-road transfer if learners abstract general principles at the highest level of mindfulness. The results supported this inference by showing positive correlation between the two types of transfer. The lowest low-road transfer would mean low level of knowledge base cumulated, and the low level of knowledge base would offer less, for learners to search similarities for high-road transfer occurrences.

Although no indication was found that low-road transfer caused high-road transfer, the significant correlation between the two types of transfer showed that level of low-road transfer would indicate similar level of high-road transfer.

Implication for Instructional Design

Based on the finding of this study, the followings are suggestions for educational practitioners.

- When the expected outcome is high-road transfer, situated learning environments should provide opportunities for learners to generate abstractions from content. The activities should be mindful, which encourages learners to generalize abstraction from the analyses of analogue and learning content, rather than less mindful, which allows learners to review pre-defined abstractions or to complete partially-defined abstractions. The results showed the highest level of mindful abstraction activities induce greater high-road transfer than the other levels of mindful abstraction activities.

- When the expected outcome is low-road transfer, the abstraction activities should be relevant to learners’ tasks or interests. The highest level of mindful abstraction activities will encourage learners’ low-road transfer regardless of relevancy. But, the results
showed the when abstraction activities are relevant to the learners’ tasks or interests, it shows more effect than when they are not.

- In selection of analogues for abstraction activities, the selection does not have to be based on the learners’ knowledge levels about analogues. The results showed no significant difference in different levels of knowledge about analogues for both types of transfer.

- Those who show a high level of performance in low-road transfer should be encouraged to do tasks that require high-road transfer for more meaningful learning, because they are likely to show high level of performance in high-road transfer too. The results showed a significant positive correlation between low-road transfer and high-road transfer.

- Those who show a low level of performance in low-road transfer should be encouraged to do tasks that require high-road transfer with the highest level of mindfulness. The highest level of mindfulness will facilitate high-road transfer and high level of performance in high-road transfer would more likely show high level of performance in low-road transfer as well. The results showed a significant positive correlation between low-road transfer and high-road transfer.

**Recommendations for Future Research**

Based on the results and the discussion of the results, the following recommendations are posed for future research.

- Even though a significant difference was found between effortless abstraction activities and effortful abstraction activities in high-road transfer, longer periods of study are
suggested for further research of high-road transfer. Longer periods of study will confirm the substantial effect of mindful abstraction activities in this study. Also, the longer period of study may shed light on the effect of the interaction of mindfulness and the use of analogues in transfer.

- More study about semi-effortful activity is suggested. Even though semi-effortful abstraction activities created no significant differences, score trends for both low-road and high-road transfer of most of the groups were higher than the groups with effortless abstraction activities and similar to the groups with effortful abstraction activities. Since various types of semi-effortful abstraction activities can be designed, studies about different formats or levels of mindfulness, or any guidance features that might promote active mindfulness can be studied.

- More detailed study about the abstractions that learners generate is suggested. Future research can investigate the quality of the abstractions that learners generate which may lead to differences in high-road transfer. The quality can be measured in terms of number of words used, number of principles generalized, the level of abstractness or generalizability, and so on. Also, the comparison of the abstraction between learner generation and the expert generation in terms of content, structure and in high-road transfer can be investigated.

- Research using multiple analogues from various topics for one task is suggested. In this study, analogues used for abstraction activities were all drawn from one subject, word processing software. However, depending on the task, the analogues can be drawn from various subjects. The effect of variation in selecting analogue will partially answer the questions regarding the conditions required for being an effective analogue.
Research investigating relationship between prior knowledge and knowledge about analogues is suggested. In this study, prior knowledge and knowledge about analogues showed positive correlation. Both prior knowledge and knowledge about analogues can contribute to the knowledge base for abstraction activities for high-road transfer. The effect of levels of both prior knowledge and knowledge about analogues may provide useful information on analogues selection for abstraction activities for high-road transfer.

Limitations of the Study

The participants of the study were undergraduate students. The results of this study are limited to the population with similar characteristics with similar knowledge levels of word processing, HTML and CSS, reasoning for transfer, etc. In addition, this study showed borderline acceptability reliability in the high-road check list.

Conclusions

The ultimate goal of learning is to “use” knowledge from the learning in our lives. Naturally the ultimate goal of education has been knowledge retention and its transfer (L. W. Anderson & Krathwohl, 2001, 1994; Marini & Genereux, 1995; McKeough et al., 1995). Educators’ quest for better transfer has proposed many theories and models. The situated learning model tries to provide better environments for learners to “use” knowledge, as well. However, because human cognition is situated in nature, providing situations intended for better learning, may hinder the ability of learners to generalize their knowledge to other situations as learning proceeds (Bereiter, 1997).
Wagner (2006) claims the need for a combination of situative and cognitive perspectives for better transfer. Mindful abstraction is an effort to encourage learners to explore their knowledge consciously and explicitly. Since the situated learning model has a weakness in learner generalization of knowledge for other situations, the addition of mindful abstraction activities to the model could promote generalization. Although the mental effort maybe intense for learners, the study results showed that learners having made that effort would be more able to generalize their knowledge to other situations. As Brown and Duguid (1996) claimed, it is important to consider both implicit situatedness and explicit abstractions in design for learning. The consideration of both situative and cognitive perspectives in instructional design should facilitate transfer and lead to meaningful learning.
REFERENCES


Web Page Developing Related Experience Survey

1. Have you ever developed a web page before? (Yes / No)

2. How long have you used an authoring tool (e.g. Dreamweaver, Front Page)? (None / Less than 1 year / 1 year or more but less than 3 years / 3 years or more but less than 5 years / More than 5 years)

3. How long have you used markup language (HTML) to make a web page? (None / Less than 1 year / 1 year or more but less than 3 years / 3 years or more but less than 5 years / More than 5 years)

4. How long have you used documenting/word processing software (e.g. Microsoft Office Word)? (None / Less than 1 year / 1 year or more but less than 3 years / 3 years or more but less than 5 years / More than 5 years)

5. Can you make the two example pages in the ad only using HTML and CSS? (Yes / No)

6. Can you make the two example pages in the poster using any documenting/word processing software (e.g. Microsoft Office Word)? (Yes / No)

7. Can you make the two example pages in the poster using an authoring tool (e.g. Dreamweaver, Front Page)? (Yes / No)


9. How frequently do you use a computer? (Everyday / 2-3 times a week / 2-3 times a month / Almost never)

10. In what occasion do you use a computer? (Use everywhere possible / Use where required / Do not use if possible / Almost never)

11. How do you feel about developing a web page using only markup language (HTML)? (Very easy / Easy / Difficult / Very difficult)

12. Do you feel comfortable using documenting/word processing software? (Very easy / Easy / Difficult / Very difficult)

-- This is end of the survey. Thank you very much. --
APPENDIX B

MICROSOFT OFFICE WORD DOCUMENTING KNOWLEDGE TEST
Microsoft Office Word Documenting Knowledge Test

Please select the best answer for each question. Some of the questions may seem like more than one answer could be correct. Select only one answer that you think is the best. If you are using any documenting software other than Microsoft Office Word, some of the questions might be unfamiliar to you. If that happens, and/or if you don’t understand the question, simply choose the last choice ‘I don’t know.’

* As you answer the following questions, imagine that you are making a cook book using Microsoft Office Word.

1. Which format is the best for writing a cooking procedure?
   a. Write text following a number
   b. Write text following a symbol
   c. Use a ‘List with Numbering’
   d. Use a ‘List with Bullets’
   e. I do not know

2. You want to insert an image that you have taken for each recipe, what do you use?
   a. Go to ‘Format’ > ‘Borders and Shading’
   b. Go to ‘Insert’ > ‘Picture’ > ‘Clip Art’
   c. Go to ‘Insert’ > ‘Picture’ > ‘Auto Shape’
   d. Go to ‘Insert’ > ‘Picture’ > ‘From File’
   e. I do not know

3. You want to change the color of the entire document. What is the best to do it?
   a. Change ‘Page Setup’
   b. Use ‘Background’ in the ‘Format’
   c. Insert a picture of solid rectangle in each page
   d. Use ‘Theme’ in the ‘Format’
   e. I do not know

4. You want to have more white space around the edges of the entire document, what do you change?
   a. Select the entire content and change its ‘Indentation’
   b. Copy the entire content and paste it in a table with narrower width
   c. Adjust ‘Margin’ in the ‘Page Setup’
   d. Change the ‘Zoom’ level
   e. I do not know

5. There is a short introduction for each recipe and you want to make the introduction with a narrower width than the recipe. What is the best way to do this?
   a. Select the introduction area and change the ‘Indentation’
   b. Select the introduction area and change the ‘page setup’
   c. Hit the space bar in each line of the introduction until you reach the satisfying width
d. ‘Cut’ the introduction and put it in a small table cell

e. I do not know

6. You want to place the inserted image right next to its recipe, side by side. What is the best way to do this?
   a. Move the image right next to the recipe
   b. Change the ‘Indentation’ of the image
   c. Change the ‘Image Wrapping Style and Alignment’ and move to the desired location
   d. Create a table with two columns and insert a recipe in one column and insert an image in the other column
   e. I do not know

7. What is the best format for the name of each recipe?
   a. Use a bigger and bolder font size and style
   b. Assign ‘Heading 1’ style for each name
   c. Assign a large space before and after each name
   d. Use a different color
   e. I do not know

8. You want to insert your own logo that you made in each page at the same location. What is the best way to do it?
   a. Select ‘Picture’ from the ‘Insert’ menu in each page
   b. Select ‘Theme’ under the ‘Format’ menu
   c. Change ‘Page Setup’
   d. Select the logo image using ‘Background’ under ‘Format’
   e. I do not know

9. What is the best way to change the format of each recipe’s name?
   a. Use ‘Replace’ in the ‘Edit’ menu
   b. Change ‘Styles and Formatting’ of recipe names
   c. Use ‘Macro’ in the ‘Tool’ menu
   d. Find and change the format of each recipe manually
   e. I do not know

10. Now that you have looked at it, the instructions of all the recipes are very short and they don’t take up much space. So you decide to arrange the recipes side by side, three at a time. What is the best way to do this?
    a. Use ‘Columns’ in the ‘Format’ menu
    b. It is not possible to arrange three recipes side by side
    c. Use ‘Text Box’ in the ‘Drawing’ tools to make three boxes aligned side by side
    d. Change ‘Margin’
    e. I do not know

11. You want to add small special sections such as history, how to handle, where to buy, etc., on some of the pages. They can be placed on either the right or left side of the recipes, depending on the layout of each page. What is the best way to do this?
a. Create a ‘Table’, with two columns, one column for the special section and the other
column for recipes
b. Use a ‘Text Box’ for special sections and place them wherever you want
c. Cannot insert the special sections unless they are placed in the same side
d. Make the special sections as images in a graphic application and then insert those
images
e. I do not know

12. You only want to change the text font style. What is the best way to change it?
a. Use ‘Macro’ in the ‘Tool’
b. Change it manually with ‘Format Painter’
c. Use ‘Replace’
d. Use ‘Styles and Formatting’
e. I do not know

13. You used bullets to list the ingredients in the recipes. Now you find a nice image, small
enough to fit for each bullet. What is the best way to replace the bullets with the image?
a. Use ‘Styles and Formatting’
b. Go to ‘Bullets and Numbering’ and change the format of the bullet
c. Use ‘Replace’ in the ‘Edit’ menu
d. Insert the image in front of each line of all the ingredients
e. I do not know

14. You made a table about measurement information between weights and volume. One column
is for volume and another column for weight. You want to add different color for each column.
What is the best way to do? c
a. Make two rectangles with different colors using ‘Drawing’ tool and insert them in
the table, one in each column
b. Select the text in each column and change shading color using ‘Borders and
Shadings’
c. Select each column and use ‘Borders and Shadings’ to change shading color
d. Select each column and use ‘Fill Color’ in ‘Drawing’ tool to change its background
color
e. I do not know

15. The text in a table is too close to the border lines of the table. You want to give more white
space between the border lines and the text in each cell. What is the best way to do? b
a. Select the text and change ‘Indentation’
b. Change ‘Cell Margin’ in the ‘Table Property’
c. Use enter key and space bar to make enough space
d. Change ‘Line Spacing’
e. I do not know
APPENDIX C

WEB-PAGE DEVELOPMENT PRIOR KNOWLEDGE TEST
HTML and CSS Coding Prior Knowledge Test

Please select the best answer for each question. Some of the questions may seem like more than one answer could be correct. Select only one answer that you think is the best. If you have not used HTML either CSS, the questions will be unfamiliar to you. If that happens and/or if you think that you don’t understand the question, simply choose the last choice “I don’t know.” It will not affect to your learning experience.

1. When you open a web-page in an internet browser, which part of the web-page coding is displayed usually?
   a) <head> section
   b) <html> section
   c) <body> section
   d) All above
   e) I don’t know

2. Which element does not make a line break automatically?
   a) <img>
   b) <p>
   c) <ul>
   d) None above
   e) I don’t know

3. You want to draw a solid-color box under a paragraph which one do you have to use?
   a) color
   b) background-color
   c) border-style
   d) All above
   e) I don’t know

4. You have two images, a big rectangle and a small circle. You want those the small circle image placed over the big rectangle in the middle of it. Which one can you use to make it happen?
   a) <a>
   b) background-image
   c) align
   d) None above
   e) I don’t know

5. There is a paragraph followed by another paragraph. You want those two paragraphs place side-by-side. Which one can you use?
   a) align
   b) width
   c) float
   d) None above
   e) I don’t know

6. You have a paragraph consisting of 5 lines. Which one affects to the width of the paragraph?
   a) Bigger margin
   b) Bigger padding
c) Bigger width  
d) All above  
e) I don’t know  

7. You want to draw a box around the several paragraphs. Which one below listed all that you need?  
   a) `<div>`  
   b) border-style  
   c) `<div>` and border-style  
   d) `<div>`, border-style and float  
   e) I don’t know  

8. You used `<div>` to insert a paragraph. What do you need to have a flexible height of the paragraph?  
   a) margin at the bottom  
   b) padding at the bottom  
   c) `<br>` at the end of the paragraph  
   d) You don’t need one  
   e) I don’t know  

9. You drew two boxes and placed them side-by-side. Which one can you use to arrange them separately, not to touch each other?  
   a) margin  
   b) padding  
   c) float  
   d) border-style  
   e) I don’t know  

10. Which element cannot contain the same element within itself?  
    a) A `<div>` element in a `<div>`  
    b) A `<p>` element in a `<p>`  
    c) A `<ul>` element in a `<ul>`  
    d) None above  
    e) I don’t know  

11. Which element can contain image element?  
    a) Heading element  
    b) Attribute element  
    c) List element  
    d) All above  
    e) I don’t know  

12. You drew a box around a paragraph. And you recognized that there is not much room at the bottom so it looks like it is cut too tightly at the bottom of the box. Which one can you use to have some more space at the bottom?  
    a) margin  
    b) border-style  
    c) padding  
    d) None above  
    e) I don’t know
APPENDIX D

HIGH-ROAD AND LOW-ROAD TRANSFER TESTS
Final Web Page Development Test

1. Introduction about the final tests

Ok! Good Job!

I sent those files and they both seems very happy about it.

There are some requests from the both clients. You will see what they want in the following pages. Read the request carefully and see that needs to be done. Make a list of what to do. That will help you to concentrate.

Keep in mind, their request can be accomplished with what we have practiced together. You do not need to know any new elements or property to make them. Even with that, there are a few things that you may feel like you haven’t done it before. Develop the page AS MUCH AS YOU CAN and submit the pages to me, EVEN IF THEY ARE NOT COMPLETED. So, do your best to solve the problem. I’m sure as you do things here, you will learn a lot.

2. First Test Scenario: Mr. Kim’s Restaurant Page Revision Request

Hello. I saw the web page. I like it a lot. Thanks.

I would like some changes though. I know that I like simple and clean design. And I even like white color background a lot. But somehow the space looks so empty. So, I wonder maybe if you can make a frame box around the content just like Kelly’s. But I still like to have the content in the middle and have more space on both right and left side, please don’t change that one. Any line style or width would be fine as long as you think they look nice.

Could you also color the background only outside the frame? Not the content area. I like to keep the white background for the content area. Well, any background color would be alright. I like all shade of green and brown, but I don’t know that will look good for the page. Why don’t you put any color that you like, and then maybe we can see it together?

It will look like the picture on the right side.

If you like to change the font color, you can change the color that matches with the background color, too.

Oh, also I think the space on both side is a bit too much. Can you reduce the space, only a little bit smaller? I want the main content takes up the space a lot, like 70% of the entire screen?

And I would like ‘times’ for the title font type. I like the current font type for the main content. But for the titles I would like times.
I like the little fans picture. You can leave it as it is. However, since I asked you to make the background a little bit different than the last one, if you think you need to change the location a little that is fine. But I would like to keep it definitely somewhere in the background and in the special as it is.

3. Kelly’s New Request: Home Page Development

Hello. I checked the web page. It looks great. Thanks.

The page looks very pretty and the file size is very small. I really like that. So, I decide to ask you to make my home page. I told you last time about my home page which I made. It looks awful. They are literally several lists of different things. In the beginning I didn’t have much to show, so I guess I was ok with make a couple of boring and terrible looking pages. But it seems like I need more than just a couple of pages and they need to be organized too.

Ok here are the things that I want.

I want you to make just one page as a prototype for my site pages. Can you work on a page that belongs to one of the main menu? I’m going to have 5 parts including ‘About Me,’ ‘My Books,’ ‘News,’ ‘Contact Information,’ and ‘My Chocolate Shop.’ I don’t have any content that goes in each part yet. But, I’m sure I will have several books under the ‘My Books’ part. Since you already have a page about my book, why don’t you borrow some of the content from the page for now? You can use the part of the book description and its title. So, each part will be main menu and, under each main menu, several sub menus will be placed, like titles of the books. The book title ‘Everything with Chocolate’ will be one of the sub menu of the ‘My Books’ main menu and you are going to make a page displayed when users select the book title. Can you make each menu as a button? You can choose the button color any way you like.

By the way, I would like to have the whole site title as ‘Kelly’s Home’ and have it placed in the middle on top of the screen. Under the big title, the menus and the book description will be presented it.

Having said that I think we need to talk about general layout before we go any further.

I would like to place all the content in the middle of the screen too with some background color, just like Mr. Kim’s.

But here is my idea. I don’t know if this is possible. First, I like to have all the menus in a narrow white bar on the left side of the screen. On the right side of the screen another bigger white box with the main content will be presented, in our case the book title and the description will be on the white box. With a background color, those two white boxes will look like two islands.

Can you even make a little drop shadow under the each white box? I think it will look even nicer.
And I don’t like the text width is changing whenever you change the window size. I want the white boxes not to change their width. But the length of the box should be changeable depends on the text length. I don’t know how much for each text, but I hope you can make it flexible.

Ok, so…the main title of the site is always on top. And a menu bar island on the left side below the title, with 5 buttons and some sub buttons. The number of sub buttons will vary depends on the part. I think the ‘My Book’ part will have definitely many sub buttons, since I have several books that are already published and will have more soon. For the sub buttons should be all 9 for now; ‘Everything with Chocolate,’ ‘In the desert,’ ‘Living a Thousand Years,’ ‘The Toughest Thing about Being a Doll,’ ‘Samantha,’ ‘The Unhappy Child,’ ‘My Foot is in My Mouth,’ ‘Will be more…’

I have one more request. You see, my friend sent me a picture that goes in the menu bar and I like the picture a lot.

Here I brought the small size of the picture so you can take a look at it. Can you put the menu button in the white space in the middle of this picture? So the prototype page that you will make will show 5 main menu buttons and 9 sub buttons under the ‘My Books’ button.

You can download the picture from these links, pen picture, coffee cup picture, and the whole picture. My friend gave me three pictures, the whole picture, top (pen) and bottom (coffee cup), just in case. I don’t know which one you have to use. I hope you have some idea about them.

As for the link of each button, why don’t you use just leave it as blank for now, like href=' '.

I think I have asked a lot. Please complete it as much as you can and show it to me. I hope I can see the page soon. Thanks!
APPENDIX E

LISTS OF HTML AND CSS COMMANDS USED IN THE TUTORIAL AND THEIR ATTRIBUTES
### Commands of HTML Used in the Tutorial and Their Attributes

<table>
<thead>
<tr>
<th>Elements Name</th>
<th>Attributes Included in the Tag</th>
<th>Element Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTML</td>
<td>html document information</td>
<td>Document root element</td>
</tr>
<tr>
<td>HEAD</td>
<td></td>
<td>Document head</td>
</tr>
<tr>
<td>TITLE</td>
<td></td>
<td>Document title</td>
</tr>
<tr>
<td>BODY</td>
<td></td>
<td>Document body</td>
</tr>
<tr>
<td>STYLE</td>
<td>type</td>
<td>Style Information</td>
</tr>
<tr>
<td>H1</td>
<td>class</td>
<td>Heading 1</td>
</tr>
<tr>
<td>H2</td>
<td>class</td>
<td>Heading 2</td>
</tr>
<tr>
<td>H3</td>
<td>class</td>
<td>Heading 3</td>
</tr>
<tr>
<td>P</td>
<td>class</td>
<td>Paragraph</td>
</tr>
<tr>
<td>IMG</td>
<td>src, class, href, alt</td>
<td>Embedded image</td>
</tr>
<tr>
<td>A</td>
<td>class, href</td>
<td>Anchor</td>
</tr>
<tr>
<td>BR</td>
<td></td>
<td>Forced line break</td>
</tr>
<tr>
<td>UL</td>
<td>class</td>
<td>Unordered list (see ol, dl)</td>
</tr>
<tr>
<td>EM</td>
<td>class</td>
<td>Emphasis</td>
</tr>
<tr>
<td>DIV</td>
<td>class</td>
<td>Container for Grouping</td>
</tr>
</tbody>
</table>

### Commands of CSS Used in the Tutorial and their and Values

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Values</th>
<th>Property Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>background-color</td>
<td>color name, #hex number, rgb(value), rgb(%value)</td>
<td>Sets the background color of an element</td>
</tr>
<tr>
<td>background-image</td>
<td>url(fileName)</td>
<td>Sets the background image of an element</td>
</tr>
<tr>
<td>background-position</td>
<td>top left, top center, top right, center left, center center, center right, bottom left, bottom center, bottom right, x-% y-%, x-position y-position</td>
<td>Sets the starting position of the background image of an element</td>
</tr>
<tr>
<td>background-repeat</td>
<td>repeat, repeat-x, repeat-y, no-repeat</td>
<td>Sets if and how the background image will be repeated in an element</td>
</tr>
<tr>
<td>color</td>
<td>same as background-color</td>
<td>Sets the foreground color of an element</td>
</tr>
<tr>
<td>border-style</td>
<td>none, hidden, dotted, dashed, solid, double, groove, ridge, inset, outset</td>
<td>Sets the border line style of an element</td>
</tr>
<tr>
<td>border-width</td>
<td>absolute length, relative length</td>
<td>Sets the border line width of an element</td>
</tr>
<tr>
<td>border-color</td>
<td>same as background-color</td>
<td>Sets the border line color of an element</td>
</tr>
<tr>
<td>font-size</td>
<td>absolute length, relative length</td>
<td>Sets the size of font</td>
</tr>
<tr>
<td>property</td>
<td>value</td>
<td>description</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>font-family</td>
<td>Times, Gill, Helvetica, serif, sans-serif, cursive, fantasy, monospace, etc.</td>
<td>Sets the name of font-family</td>
</tr>
<tr>
<td>float</td>
<td>right, left, none</td>
<td>Sets an element free from the display rule and floats any side either right or left</td>
</tr>
<tr>
<td>list-style-type</td>
<td>none, disc, circle, square, etc.</td>
<td>Sets the type of the list-item marker</td>
</tr>
<tr>
<td>margin</td>
<td>absolute length, relative length</td>
<td>Sets the space between the content border and its surrounding element Specify a side by margin-top, margin-right, margin-left, and margin-bottom</td>
</tr>
<tr>
<td>padding</td>
<td>absolute length, relative length</td>
<td>Sets the space between the content border and its actual content Specify a side by padding-top, padding-right, padding-left, and padding-bottom</td>
</tr>
<tr>
<td>text-align</td>
<td>left, right, center, justify</td>
<td>Align the text in an element</td>
</tr>
</tbody>
</table>
The Second Test Situation: Kelly's Home Page Development

List of Requests Summary

1. basic web-page structure with the book description from 'Everything with Chocolate' page (title, sub-headings, menus, main content)
2. all the content take up about 80% of the screen in the middle with a background color
3. a narrow white menu bar that contains all the menu items with fixed width (241 px)
4. a big white box for the main content with a flexible width
5. menu bar on the left and main content box on the right, side-by-side, located separately
6. a plain solid color rectangle button for each main-menu item
7. a drop shadow below the each white box
8. the image in the menu bar with a flexible height

Task analysis for each listed item

1. basic web-page structure with the book description from 'Everything with Chocolate' page

   I want you to make just one page as a prototype for my future web site. My site will have 5 major parts, including 'About Me', 'My Books', 'News', 'Contact Information', and 'My Chocolate Shop'. I don't have any content that goes in each part yet. But, I am sure I will have several web pages about my books in the 'My Books' section. Since you already have a page about my book, why don't you use some of the content from that page for now? You can use the book description and its title from the page...

   I want to have a menu bar that shows all 5 links to the various parts so visitors can click and browse around. And, once a part is selected, then a list of links that belongs to the selected part will be presented. Let's call the 5 parts 'main-menus', and the links of each part 'sub-menus'. So, the prototype page will show 5 main menus in the menu bar, and under the main-menu called 'My Books', a list of book titles will be presented as sub-menus. Assuming a visitor selects the book title, 'Everything with Chocolate', the page will show the book title and its description in the page as main content. The rest of the book titles are 'In the desert', 'Living a Thousand Years', 'The Toughest Thing about Being a Doll', 'Samantha', 'The Unhappy Child', 'My Foot is in My Mouth', and 'There will be more...'

   ...As for the link of each button, why don't you use just leave it as blank (href="") for now.

* pre-condition: You have all the text typed in the web-page. Also, you have the basic 4 elements (<html><head><style><body>) in your web-page and the all text in the body element, assuming learners know what the 4 basic elements are and only the text in the body element will be displayed on the screen. However, since no other elements have been assigned, only a long string of text will be displayed on the screen, without any line breaking, different font side, or any other styling.

* sub-goals for this task: 1. analyze the text to break the text into parts according to its function (headings, plain text description, etc...), 2. assign appropriate element code for each part of the text, and 3. add a blank URL for the links.

   1. analyze the situation to set the sub-goal(s) for the statement
      A. interpret the statement
      B. determine the sub-goal for the statement (structure the text of the web-page)
   2. determine which one (CSS or HTML or both) to change or add more
      A. interpret the attribute of page structuring
      B. recall that HTML elements are used for structuring tasks
      C. classify page structuring into structuring using HTML not styling using CSS
   3. analyze the content by reading and comprehension
      A. interpret the meaning and its function of each sentence in the text
      B. identify the type of structure of each sentence in the text
   4. evaluate the current structure of the text display
      A. recognize the difference between the current structure and the desired structure (no title in the page)
      B. detect the problem of the display (page title should be displayed on top of the screen)
   5. generate a possible solution for the problem
      A. determine the function of 'page title' (representing the main idea/theme of the entire document)
      B. infer the meaning of the function (it means, in this case, the page title text should be in a separate line, looks stand out from the rest of content, and be displayed on top of the screen)
      C. recall (or identify from the reference table) the element that provides the function for 'page title' (h1)
   6. assign h1 to the 'page title' text
      A. recall the rule of making an h1 (<h1>the text in the middle</h1>)
      B. locating the appropriate place of h1 (before and after the text of 'Kelly's Home')
      C. type it in
   7. check the web-page display
   8. evaluate the current structure of the text display
A. recognize the difference between the current structure and the desired structure (no ‘second-level heading’ for the main content area, which is ‘Everything with Chocolate’).
B. detect the problem of the display (the ‘second-level headings’ should be displayed)
9. generate a possible solution for the problem
A. determine the function of a ‘second-level heading’ (representing the main idea of the paragraph that follows)
B. infer the meaning of the function (it means, in this case, a ‘second-level heading’ text should be in a separate line, looks stand out from the rest of content, and be displayed right before the representing paragraph)
C. recall (or identify from the reference table) the element that provide the function for a ‘second-level heading’ (h2)
10. assign h2 to the ‘second-level heading’ texts
A. recall the rule of making an h2 (<h2>the text in the middle</h2>)
B. locating the appropriate place of h2 (before and after the text ‘Everything with Chocolate’)
C. type it in
11. check the web-page display
12. evaluate the current structure of the text display
A. recognize the difference between the current structure and the desired structure (no ‘third-level heading’ for the each description section, such as ‘What this book is about’ and ‘Who the author is’) B. detect the problem of the display (the ‘third-level headings’ should be displayed)
13. generate a possible solution for the problem
A. determine the function of a ‘third-level heading’ (belonging to the ‘second-level heading’ and representing the main idea of the paragraph that follows)
B. infer the meaning of the function (it means, in this case, a ‘third-level heading’ text should be in a separate line, looks stand out from the rest of content, and be displayed right before the representing paragraph but below the ‘second-level heading’ that contains)
C. recall (or identify from the reference table) the element that provides the function for a ‘third-level heading’ (h3)
14. assign h3 to the ‘third-level heading’ texts
A. recall the rule of making an h3 (<h3>the text in the middle</h3>)
B. locate the appropriate place of h3
C. type it in
15. check the web-page display
16. evaluate the current structure of the text display
A. recognize the difference between the current structure and the desired structure (no main-menu items for the 5 main parts in this web-side) B. detect the problem of the display (the main-menu items should be displayed usually in the beginning of a page to give general idea about the structure of the entire web-site)
17. generate a possible solution for the problem
A. determine the function of a main-menu (presenting the entire structure of the site)
B. interpret the attribute of the function (presenting a serieese of short part names, looks stand out than the rest of the content but gives similarities among the main-menu items, and provided with link that lead to each main part of the site)
C. infer the meaning of the function (it means, in this case, it needs to be placed at the beginning part of the coding, structurally provide different presentation from the rest of the content but looks same among the each part name texts)
D. recall (or identify from the reference table) the element, list, has padding and margin values as default values in nature
E. infer the list element provide a function of presenting the entire structure
18. assign ul to the ‘list’ texts
A. recall the three types of lists (ordered, unordered, definition lists)
B. select appropriate type
   i. recognize the main-menu doesn’t have any sequential order
      ii. determine to use unordered list
C. recall the rule of making an ul (<ul><li>each list item</li></ul>)
D. locate the appropriate place of ul (right under the page title, h1 element)
E. recall the related element, a, to provide each item a link
F. type it in (<li><a href="location">listed item</a></li>)
19. check the web-page display
20. evaluate the current structure of the text display
A. recognize the difference between the current structure and the desired structure (no sub-menu items for the 8 book links)
B. detect the problem of the display (the sub-menu items should be displayed usually right under the main-menu item that the sub-menu belongs to)
21. generate a possible solution for the problem
A. determine the function of a main-menu (presenting the sub contents of one of main parts)
B. interpret the attribute of the function (presenting a serieese of short names, looks stand out than the rest of the content but gives similarities among the sub-menu items, provide visual hints that all the sub-menu items belong to on main-menu item, and provided with link that lead to each main part of the site)
C. infer the meaning of the function (it means, in this case, it needs to be placed under the main-menu item, ‘My Books’ in the coding, structurally provide different presentation from the rest of the content but looks same among the each part name texts)
D. recall (or identify from the reference table) the element, list, has padding and margin values as default values in nature and can be placed under a listed item
E. infer the nested list element provide a function of presenting the sub-contents of one main-menu item
22. assign nested ul to the sub-menu texts
   A. recall the rule of making an ul (<ul><li>each list item</li><ul><li>nested list item</li></ul></ul>)
   B. locate the appropriate place of nested ul (<ul><li>My Books</li><ul><li>nested list item</li></ul></ul>)
   C. recall the related element, a, to provide each item a link
   D. type it in (<li><a href="location">listed item</a></li>)

23. check the web-page display
24. evaluate the current structure of the text display
   A. recognize the difference between the current structure and the desired structure (no description about the book)
   B. detect the problem of the display (contents should be presented under each sub-headings)

25. generate a possible solution for the problem
   A. determine the function of a paragraph (presenting information about one small topic)
   B. infer the meaning of the function (it means, in this case, the text for each favorite dish and each special information, should be placed in a paragraph)
   C. recall (or identify from the reference table) the element that provides the function for a paragraph (p)

26. assign nested p to the paragraph texts
   A. recall the rule of making an p (<p>texts for a paragraph</p>)
   B. locate the appropriate place of nested ul
   C. type it in

2. all the content take up about 80% of the screen in the middle with a background color

I would like to place all the content in the middle of the screen with a background color, just like Mr. Kim's...I want the menu bar has the width of the background image that I am going to show you later. The image width is 241px. As for the width of the main content in the box, I want it to be flexible, so both the menu bar and the main content, together, will take up about 80% of the screen width at all time...

* pre-condition: You have all the text typed in the web-page from the task 1 (p.144). Also, the text has it's own structure (title, headings, paragraphs, lists, etc...) from the task 1, too. The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.

* sub-goals for this task: place all the content in the middle with the width 80% of the screen

1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (place all the content in the middle with the width 80% of the screen)

2. generate a solution(s) for the sub-goal
   A. identify conditions of the sub-goal (located in the middle, and take up 80% width)
   B. generate a solution for each condition until application is feasible
      i. generate a solution(s) that meets the first condition, 'located in the middle'
         1. recall the conditions of the sub-goal
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize locating in the middle as a styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
      3. infer the function that would fulfill the condition
         A. infer the function(s) of a code that is searched (placing all the elements in the middle of the screen)
         B. recall a case(s) with the same function (Mr. Kim's restaurant page)
         C. recall the style code(s) that served the function in the old case. (‘margin’)
         D. determine to use the style code for the current task
      4. check the feasibility of using the code
         A. recall the rule of using the style code, margin (‘HTML element name’{margin: ‘value’;})
         B. recognize the un-identified (HTML element, and the value)
         C. recall that the body element was used for placing all the element in the middle
         D. infer the needs of acknowledgement of the value
      ii. generate a solution(s) that meets the second condition, 'take up 80% width'
         1. recall the conditions of the sub-goal
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize selecting width as a styling task
            C. classify the selecting width into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
      3. infer the function that would fulfill the condition
         A. infer the function(s) of a code that is searched (assigning 80% width of the screen)
         B. recall a case(s) with the same function (Mr. Kim's restaurant page)
3. a narrow white menu bar that contains all the menu items with fixed width (241 px)

I want to have a menu bar that shows all 5 links to the various parts so visitors can click and browse around. And, once a part is selected, then a list of links that belongs to the selected part will be presented. Let’s call the 5 parts ‘main-menus’, and the links of each part ‘sub-menus’. So, the prototype page will show 5 main menus in the menu bar, and under the main-menu called ‘My Books’, a list of book titles will be presented as sub-menus...

...I’d like to have the menu bar in a narrow white bar on the left side...I want the menu bar has the width of the background image that I am going to show you later. The image width is 241px...

* pre-condition: You have all the text typed in the web-page from the task 1 (p. 144). Also, the text has it’s own structure (title, headings, paragraphs, lists, etc...) from the task 1, too. The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.

* sub-goals for this task: 1. display the menu items in a white box, and 2. make the menu bar with 241 px width

1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (display the menu items in a white box, and make the menu bar with 241 px width)

2. generate a solution(s) for the first sub-goal (display the menu items in a white box)
   A. identify conditions of the sub-goal (make it white, make it a solid bar, and contain the menu texts)
   B. generate a solution for each condition until application is feasible
      i. generate a solution(s) that meets the first condition, ‘make it white’
         1. recall the conditions of the sub-goal (make it white)
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize making it white is styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
      3. infer the function that would fulfill the condition
         A. infer the function(s) of a code that is searched (a code that provide a function of coloring-in to make it white)
         B. recall a case(s) with the same function (none exactly the same)
         C. generalize the function until a case with the same generalized function is found (coloring-in any object)
            i. interpret the function
            ii. eliminate the detail information of the function to be more general
            iii. recall a case(s) that uses the generalized function (two cases of ‘coloring-in the entire webpage screen’)
         D. recall the style code(s) that served the function for the two old cases. (‘background-color’)
         E. determine to use the style code for the current task
   4. check the feasibility of using the code
      A. recall the rule of using the style code, background-color ('HTML element name'){background-color: white;}
      B. recognize the un-identified (which html element is unknown yet)
      C. infer the needs of acknowledgement of the html element
         i. generate a solution(s) that meets the second condition, ‘make it a solid bar’
            1. recall the conditions of the sub-goal (make it a solid bar)
            2. determine which one (CSS or HTML or both) to change or add more
               A. interpret the condition
               B. recognize make it a solid bar is styling task
               C. classify the condition into styling task
               D. recall that CSS is used for styling task
               E. determine to use CSS for the task
3. infer the function that would fulfill the condition
   A. infer the function(s) of a code that is searched (a code that provide a function of making a solid bar)
   B. recall a case(s) with the same function (none exactly the same)
   C. generalize the function until a case with the same generalized function is found (making a rectangular figure)
      i. interpret the function
      ii. eliminate the detail information of the function to be more general
      iii. recall a case(s) that uses the generalized function (two cases of ‘making a rectangular figure’: rectangular line and highlighting)
   D. recall the style code(s) that served the function for the two old cases. (‘border-style’ and ‘background-color’)
   E. generalize the cases until the similarity is found (‘element’{border-style: solid;} and element{background-color: pink;})
      i. interpret each case (div{border-style: solid;} and a:link{background-color: pink;})
      ii. compare the two cases (what makes the both different style codes allow to generate a rectangular figure?)
      iii. infer the similarity (both elements are surrounded by an invisible rectangle, which can be colored-in or outlined)
   F. determine to use the selected style code, background-color, to any element for the current task
4. check the feasibility of using the code
   A. recall the rule of using the style code, background-color (‘HTML element name’{background-color: white;})
   B. recognize the un-identified (which html element is unknown yet)
   C. infer the needs of acknowledgement of the html element to apply
      i. generate a solution(s) that meets the third condition, ‘contain the menu texts’
         1. recall the conditions of the sub-goal (contain the menu texts)
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize containing menu texts is structuring task
            C. recall that menu texts are already assigned
            D. recall that the selected style code has unidentified HTML element
            E. classify the conditions into using both HTML for locating and CSS for styling tasks
            F. determine to use both for the task
      3. check the feasibility of using the code
         A. recall the style code rule that has been determined for the task (‘HTML element name’{background-color: white;})
         B. infer to use the element that already contains menu texts (ul)
3. assign the selected code(s) and to the appropriate element(s)
   A. recall the newly determined style code rule (ul{background-color: white;})
   B. recall the styling can affect to all the ul elements
   C. interpret the style should affect to only the menu list not any other ordinary lists
   D. recall to use the option, ‘class’ for limited application of a style
   E. determine to use ‘class’
   F. assign a class to the element
      i. interpret the list element (ul element contains menu texts)
      ii. select a unique name (e.g.: menubartext)
      iii. type the name with the option, class, in (<ul class=menubartext>
   G. assign the background-color style code
      i. recall the rule of making a new style section with a class ‘element name’{class name’( })
      ii. recall the newly created class name with the element
      iii. type the style code in a new style section (ul.menubartext{background-color: white;})
4. check the page display
5. evaluate the result
6. generate a solution(s) for the second sub-goal (assign 241 px for the width of the box)
   A. identify conditions of the sub-goal (241 px for the width)
   B. generate a solution for the condition until application is feasible
      i. generate a solution(s) that meets the first condition, ‘241 px for the width’
         1. recall the conditions of the sub-goal (241 px for the width)
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize assigning a specific width is styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
      3. recall (or identify from a reference table) the style code for the function of ‘assigning the width’ (width)
      4. determine to use the style code for the current task
      5. check the feasibility of using the code
         A. recall the rule of using the style code, width (ul{width: 241px;})
         B. determine it is feasible to assign the style code
7. assign the style code
4. A big white box for the main content with a flexible width

...Since you already have a page about my book, why don't you use some of the content from that page for now? You can use the book description and its title from the page.

...Assuming a visitor selects the book title, 'Everything with Chocolate', the page will show the book title and its description in the page as main content...

...But here is my idea: first, I’d like to have the menu bar in a narrow white bar on the left side. On the right side, another bigger white box with main content will be displayed; in our case, the book title, ‘Everything Chocolate,’ and the some of the descriptions will be in the right side box. Make sure that they are not overlapped to each other. I want them to be separated...

I want the menu bar has the width of the background image that I am going to show you later. The image width is 241px. As for the width of the main content in the box, I want it to be flexible, so both the menu bar and the main content, together, will take up about 80% of the screen width at all time. Also, can you make the height of the menu bar flexible too, so it is changeable depending on the number of menu items. I don’t know how much links will I have and it will be all different in each part, so I think it is very important to have a flexible height...

* pre-condition: You have all the text typed in the web-page from the task 1 (p.144). Also, the text has it’s own structure (title, headings, paragraphs, lists, etc...) from the task 1, too. The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.

* sub-goals for this task: 1. display the main content in a big white box

1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (display the main content in a white box)

2. generate a solution(s) for the first sub-goal (display the menu items in a white box)
   A. identify conditions of the sub-goal (make it white, make it a solid bar, and contain the menu texts)
   B. generate a solution for each condition until application is feasible
      i. generate a solution(s) that meets the first condition, ‘make it white’
         1. recall the conditions of the sub-goal (make it white)
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize making it white is styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
         3. infer the function that would fulfill the condition
            A. infer the function(s) of a code that is searched (a code that provide a function of coloring-in to make it white)
            B. recall a case(s) with the same function (none exactly the same)
            C. generalize the function until a case with the same generalized function is found (coloring-in any object)
               i. interpret the function
               ii. eliminate the detail information of the function to be more general
               iii. recall a case(s) that uses the generalized function (two cases of ‘coloring-in the entire web-page screen’)
            D. recall the style code(s) that served the function for the two old cases. (‘background-color’) 
            E. determine to use the style code for the current task
        4. check the feasibility of using the code
           A. recall the rule of using the style code, background-color ('HTML element name'='background-color: white;')
           B. recognize the un-identified (which html element is unknown yet)
           C. infer the needs of acknowledgement of the html element
      ii. generate a solution(s) that meets the second condition, ‘make it a solid bar’
         1. recall the conditions of the sub-goal (make it a solid bar)
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize make it a solid bar is styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
         3. infer the function that would fulfill the condition
I want to call my personal website 'Kelly's Home' and have that title placed in the middle on the top of every page. Below the title, the menu bar and the main content will be presented side-by-side...
...But here is my idea: first, I’d like to have the menu bar in a narrow white bar on the left side. On the right side, another bigger white box with main content will be displayed; in our case, the book title, ‘Everything Chocolate,’ and the some of the descriptions will be in the right side box. Make sure that they are not overlapped to each other. I want them to be separated..

* pre-condition: You have all the text typed in the web-page from the task 1 (p.144). Also, the text has it’s own structure (title, headings, paragraphs, lists, etc...) from the task 1, too. The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.

* sub-goals for this task: 1. display the menu bar on the left and main content on the right, side-by-side, and 2. display them separately.

1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (display the menu bar on the left and main content on the right, side-by-side, and display the two boxes not to touch each other)

2. generate a solution(s) for the first sub-goal (display the menu bar on the left and main content on the right, side-by-side)
   A. identify conditions of the sub-goal (menu bar on the left, and main content on the right next to main menu)
   B. generate a solution for each condition until application is feasible
      i. generate a solution(s) that meets the first condition, ‘menu bar on the left’
         1. recall all the element is displayed from top to bottom and left to right.
      ii. generate a solution(s) that meets the second condition, ‘main content on the right’
         1. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize making it ‘be on the right’ is styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
         2. infer the function that would fulfill the condition
            A. infer the function(s) of a code that is searched (placing elements on the right side)
            B. recall a case(s) with the same function (placing div ‘special box’ element on the right side)
            C. recall the style code(s) that served the function for the old case. (‘float’)
            D. determine to use the style code for the current task
         3. check the feasibility of using the code
            A. recall the rule of using the style code, float (‘HTML element’{float: right;})
            B. recognize the un-identified (the value has not been selected)
            C. recall the condition (place on the right side)
            D. evaluate the value result
               i. infer the implication result of the style code, float
               ii. recall the old case of moving the div element (elements below the div elements will come up and fill the empty space right next to the div element)
               iii. recognize that there is no elements below the main content to come up
               iv. infer that it is elements of the main content that needs to come up and fill the empty space
         4. infer the needs of change of element to assign the style code, float (not the elements for the main content, but the element that contains menu bar so the right side can come up)
   3. assign float style code to the element that contains menu bar on the left side
      A. locating the element containing the main-menu (could be either div or ul)
      B. recall the newly determined style code rule (div{float: ‘value’;} or ul{float: ‘value’;})
      C. select the value (left)
      D. recall the styling can affect to all the ul elements
      E. interpret the style should affect to only the element containing the menu, not any other elements
      F. recall to use the option, ‘class’ for limited application of a style
      G. determine to use ‘class’
      H. assign a class to the element
         i. select a unique name (e.g.: menubar)
         ii. type the name with the option, class, (<div class=menubar> or <ul class=menubar>)
      I. assign the style code, float
         i. recall the rule of making a new style section with a class(‘element name’.’class name’{ })
         ii. recall the newly created class name with the element
         iii. type the style code in a new style section (div{float: ‘value’;} or ul{float: ‘value’;})
   4. check the page display
   5. evaluate the current web-page display
      A. recognize the difference between the current style and the desired style (the main content is displayed next to the menu bar and below the menu bar, so it does not look like it is in another box)
      B. detect the problem of the current display (the content should be displayed in the separate box and not under the menu bar)
      C. recall the second sub-goal
      D. infer the second sub-goal is addressing the current display problem
6. generate a solution(s) for the second sub-goal (display the two boxes not to touch each other)
   A. identify the conditions of the second sub-goal (displayed two boxes with some space between that separates the two boxes)
   B. generate a solution that meets the condition
      i. determine which one (CSS or HTML or both) to change or add more
         1. interpret the condition
         2. recognize making the condition is styling task
         3. classify the condition into styling task
         4. recall that CSS is used for styling task
         5. determine to use CSS for the task
      ii. infer the function that would fulfill the condition
         1. infer the function(s) of a code that is searched (separating two elements)
         2. recall a case(s) with the same function (a text flowing down each favorite dish picture)
         3. recall the style code(s) that served the function of separating two elements (margin)
         4. determine to use the style code for the current task
      iii. check the feasibility of using the code
         1. recall the rule of using the style code, 'HTML element'{margin: 'value';}
         2. recognize the un-identified (the value and the HTML element has not been selected)
         3. infer the needs of identification of appropriate HTML element
      iv. infer the function of the style code, margin
         1. recall the old case using margin (margin was used to the text not the image)
         2. generalize the function until the similarity is found between the current task and the old case (elements that flow should have margin)
            A. interpret the function
            B. eliminate the detail information of the function to be more general (text → flowing element)
         3. apply the generalized function to the current case (flowing element → main content)
         4. infer the needs of using margin to the content elements
         5. recognize there is more than one element for the content
         6. interpret the style code, margin, will have to be every element
         7. infer the needs of all the content in one element
      v. determine to have another condition, all the elements for the main content should be placed in one element
      vi. infer the function of the condition (containing several elements in one)
      vii. recall a case(s) with the same function (div for special box, and containing two lists)
      viii. determine to assign div for HTML element
   7. assign the selected code(s) and HTML element to the appropriate places
      A. assign div element
         i. recall the rule of making div element (<div>several elements</div>)
         ii. locate the right place for div element (right before the title 'Everything with Chocolate' right after the end of content elements that each individual has)
         iii. type it in the div element
      B. assign margin style code
         i. recall the styling can affect to all the div elements
         ii. interpret the style should affect to only the main content div not any other ordinary div elements
         iii. recall to use the option, ‘class’ for limited application of a style
         iv. determine to use ‘class’
         v. assign a class to the element
            1. locate the div element (div element contains main content)
            2. select a unique name (e.g.: maintext)
            3. type the name with the option, class, in (<div class=maintext>
      vi. assign the margin style code
         1. recall the rule of making a new style section with a class(div.maintext{margin: ‘value’;})
         2. recall the option of the side (which side are you going to assign margin?)
         3. determine the option (left side of the content)
         4. recall the width of the menu bar is 241px
         5. infer the margin should be greater than 241px
         6. determine the value (e.g. 250px)
         7. type it in (div.maintext{margin-left: 250px; })
   8. check the page display
   9. evaluate the result

6. a plain solid color rectangle button for each main-menu item

   By the way, can you make the 5 main-menu items look like buttons? I don’t want them to look like ordinary links. Maybe you can use a plain solid color rectangle for a button. Please do not use a graphic. I would like to keep the file size as small as possible...

* pre-condition: You have all the text typed in the web-page from the task 1 (p.144). Also, the text has it’s own structure (title, headings, paragraphs, lists, etc...) from the task 1, too. The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.
1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (make a solid color button for each main-menu item)
2. generate a solution(s) for the sub-goal
   A. identify conditions of the sub-goal (be a solid color, be a button, and contains the main-menu item texts)
   B. generate a solution for each condition until application is feasible
   i. generate a solution(s) that meets the first condition, 'be a solid color'
      1. recall the conditions of the sub-goal
      2. determine which one (CSS or HTML or both) to change or add more
         A. interpret the condition
         B. recognize the condition is styling task
         C. classify the condition into styling task
         D. recall that CSS is used for styling task
         E. determine to use CSS for the task
   3. infer the function that would fulfill the condition
      A. infer the function(s) of a code that is searched (coloring-in a solid color)
      B. recall a case(s) with the same function (none exactly the same)
      C. generalize the function until a case with the same generalized function is found (coloring-in)
         i. interpret the function
         ii. eliminate the detail information of the function to be more general
         iii. recall a case(s) that uses the generalized function (two cases of 'coloring-in the entire webpage screen')
      D. recall the style code(s) that served the function for the two old cases. ('background-color')
      E. determine to use the style code for the current task
   4. check the feasibility of using the code
      A. recall the rule of using the style code, background-color ('HTML element name'{background-color: 'value';})
      B. recognize the un-identified (which html element is unknown yet and the value has not determined)
      C. infer the needs of acknowledgement of the html element
         i. generate a solution(s) that meets the second condition, 'be a button'
            1. recall the conditions of the sub-goal
            2. determine which one (CSS or HTML or both) to change or add more
               A. interpret the condition
               B. recognize the condition is a decorative task
               C. classify the condition into decorative task
               D. recall that CSS is used for decorative task
               E. determine to use CSS for the task
            3. infer the function that would fulfill the condition
               A. infer the function(s) of a code that is searched (making a button)
               B. recall a case(s) with the same function (none exactly the same)
               C. generalize the function until a case with the same generalized function is found (making a rectangular figure)
                  i. interpret the function
                  ii. eliminate the detail information of the function to be more general
                  iii. recall a case(s) that uses the generalized function (two cases of 'making a rectangular figure': rectangular line and highlighting)
               D. recall the style code(s) that served the function for the two old cases. ('border-style' and 'background-color')
               E. generalize the cases until the similarity is found ('element'{border-style: solid;} and element{background-color: pink;})
                  i. interpret each case (div{border-style: solid;} and a:link{background-color: pink;})
                  ii. compare the two cases (what makes the both different style codes allow to generate a rectangular figure?)
                  iii. infer the similarity (both elements are surrounded by an invisible rectangle, which can be colored-in or outlined)
               F. determine to use the selected style code, background-color, to any element for the current task
            4. check the feasibility of using the code
               A. recall the rule of using the style code, background-color ('HTML element name'{background-color: 'selected value';})
               B. recognize the un-identified (which html element is unknown yet)
               C. infer the needs of acknowledgement of the html element to apply
                  i. generate a solution(s) that meets the third condition, 'contain the main-menu text'
                     1. recall the conditions of the sub-goal
                     2. determine which one (CSS or HTML or both) to change or add more
                        A. interpret the condition
                        B. recognize containing menu texts is structuring task
                        C. recall that menu texts are already assigned
                        D. recall that the selected style code has unidentified HTML element
E. classify the conditions into using both HTML for locating and CSS for styling tasks
F. determine to use both for the task
3. check the feasibility of using the code
   A. recall the style code rule that has been determined for the task ('HTML element name'{background-color: 'selected value';})
   B. infer to use the element that already contains menu texts (li)
3. assign the selected code(s) and to the appropriate element(s)
   A. recall the newly determined style code rule (ul{background-color: white;})
   B. recall the styling can affect to all the li elements
   C. interpret the style should affect to only the main-menu list item not any other ordinary list items
   D. recall to use the option, ‘class’ for limited application of a style
   E. determine to use ‘class’
   F. assign a class to the element
      i. locate the list element (li elements contains main-menu text)
      ii. select a unique name (e.g.: mainbutton)
      iii. type the name with the option, class, in (<li class=mainbutton>)
   G. assign the background-color style code
      i. recall the rule of making a new style section with a class('element name'.class name'{ })
      ii. recall the newly created class name with the element
      iii. type the style code in a new style section (li.mainbutton{background-color: 'selected value';})
4. check the page display
5. evaluate the result
   A. recognize the underline below each main-menu item
   B. recognize the button fit too tight to around the text
   C. recognize the each main-menu item has a bullet
   D. infer the visual conditions of being a button (no underline, no bullet, and some space around the text)
6. determine to add more conditions (be a plain text with for the link, be a spacious around the text, and be separated from one button to another)
7. Generate the solution for each condition
   A. Generate a solution for the first condition (be a plain text with for the link)
      i. determine which one (CSS or HTML or both) to change or add more
         1. interpret the condition
         2. recognize the condition is styling task
         3. classify the condition into styling task
         4. recall that CSS is used for styling task
         5. determine to use CSS for the task
      ii. infer the function that would fulfill the condition
         1. infer the function of the condition (removing underline of a link)
         2. recall a case(s) with the same function (link to the ‘author’s home page’)
         3. recall the style code(s) that served the function for the old case. (text-decoration: none;)
         4. determine to use the style code for the current task
   B. Generate a solution for the second condition (no bullet)
      i. determine which one (CSS or HTML or both) to change or add more
         1. interpret the condition
         2. recognize the condition is styling task
         3. classify the condition into styling task
         4. recall that CSS is used for styling task
         5. determine to use CSS for the task
      ii. infer the function that would fulfill the condition
         1. infer the function of the condition (removing bullet from a list item)
         2. recall a case(s) with the same function (a list of Kim’s restaurant)
         3. recall the style code(s) that served the function for the old case. (list-style-type: none;)
         4. determine to use the style code for the current task
   C. Generate a solution for the third condition (be a spacious around the text)
      i. determine which one (CSS or HTML or both) to change or add more
         1. interpret the condition
         2. recognize the condition is styling task
         3. classify the condition into styling task
         4. recall that CSS is used for styling task
         5. determine to use CSS for the task
      ii. infer the function that would fulfill the condition
         1. infer the function of the condition (spacing around the list item text)
         2. recall a case(s) with the same function (none exactly the same)
         3. generalize the function until a case with the same generalized function is found (spacing around the content of an element)
            A. interpret the function
            B. eliminate the detail information of the function to be more general
            C. recall a case(s) that uses the generalized function (two cases spacing the entire web-page screen’ and spacing inside the special box div element)
         4. recall the style code(s) that served the function for the old case. (padding: ‘value’;)
         5. determine to use the style code for the current task
D. Generate a solution for the third condition (be separated from one button to another)
   i. determine which one (CSS or HTML or both) to change or add more
      1. interpret the condition
      2. recognize the condition is styling task
      3. classify the condition into styling task
      4. recall that CSS is used for styling task
      5. determine to use CSS for the task
   ii. infer the function that would fulfill the condition, be separated from one button to another
      1. infer the function of the condition (arranging buttons)
      2. recall a case(s) with the same function (none exactly the same)
      3. generalize the function until a case with the same generalized function is found (placing objects apart)
         A. interpret the function
         B. eliminate the detail information of the function to be more general
         C. recall a case(s) that uses the generalized function (placing favorite dish picture and its description, special box and favorite dish descriptions)
      4. recall the style code(s) that served the function for the old case. (margin or padding)
      5. determine which style code to use for the current task (margin)
         A. compare the two style code
            i. interpret the two cases using margin or padding
            ii. infer the difference between the margin and padding (margin is a out side the invisible border line, padding is inside the border line)
         B. identify which space is needed to arrange the buttons sequentially (margin)
         C. determine to use margin

8. assign the selected code(s) and to the appropriate element(s)
   A. assign the style code for the underline
      i. recall the styling can affect to all the li elements
      ii. interpret the style should affect to only the li elements of the main-menu not any other ordinary li elements
      iii. recall to use the option, ‘class’ for limited application of a style
      iv. determine to use ‘class’
      v. assign a class to the element
         1. locate the li element (li elements contain a main-menu item)
         2. select a unique name (e.g.: mainbutton)
         3. type the name with the option, class, in (<li class=mainbutton>
         v. assign the style code, text-decoration
         1. recall the rule of making a new style section with a class (li.mainbutton{text-decoration: none; })
         2. type it in
   B. assign the style code for the bullet
      i. recall the styling can affect to all the li elements
      ii. interpret the style should affect to only the li elements of the main-menu not any other ordinary li elements
      iii. recall to use the option, ‘class’ for limited application of a style
      iv. determine to use ‘class’
      v. assign a class to the element
         1. locate the li element (li elements contain a main-menu item)
         2. select a unique name (e.g.: mainbutton)
         3. type the name with the option, class, in (<li class=mainbutton>
         vi. assign the style code, list-style-type
         1. recall the rule of making a new style section with a class (li.mainbutton{list-style-type: none; })
         2. type it in
   C. assign the style code for the some extra space inside the button
      i. recall the styling can affect to all the li elements
      ii. interpret the style should affect to only the li elements of the main-menu not any other ordinary li elements
      iii. recall to use the option, ‘class’ for limited application of a style
      iv. determine to use ‘class’
      v. assign a class to the element
         1. locate the li element (li elements contain a main-menu item)
         2. select a unique name (e.g.: mainbutton)
         3. type the name with the option, class, in (<li class=mainbutton>
         vi. assign the style code, padding
         1. recall the rule of making a new style section with a class (li.mainbutton{padding: 'value'; })
         2. type it in
   D. assign the style code for the some extra space between the buttons
      i. recall the styling can affect to all the li elements
      ii. interpret the style should affect to only the li elements of the main-menu not any other ordinary li elements
      iii. recall to use the option, ‘class’ for limited application of a style
      iv. determine to use ‘class’
      v. assign a class to the element
         1. locate the li element (li elements contain a main-menu item)
         2. select a unique name (e.g.: mainbutton)
         3. type the name with the option, class, in (<li class=mainbutton>
         vi. assign the style code, margin
         1. recall the rule of making a new style section with a class (li.mainbutton{margin: 'value'; })
Can you also make a little drop shadow right below the main content box and the menu bar to give a little depth?

* pre-condition: You have all the text typed in the web-page from the task 1 (p. 144). Also, the text has its own structure (title, headings, paragraphs, lists, etc..) from the task 1, too. Besides task 1, it is also assumed that the both white boxes are made at the task 3 (p. 147) and task 4 (p. 149). The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.

* sub-goals for this task: 1. display a drop shadow right under the menu bar and the main content box

1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (a drop shadow right under the menu bar and the main content box)

2. generate a solution(s) for the sub-goal
   A. identify conditions of the sub-goal (be a drop shadow, and be located right under the boxes)
   B. generate a solution for each condition until application is feasible
      i. generate a solution(s) that meets the first condition, ‘be a drop shadow’
         1. recall the conditions of the sub-goal
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize the condition is styling task
            C. classify the condition into styling task
            D. recall that CSS is used for styling task
            E. determine to use CSS for the task
      3. infer the function that would fulfill the condition
         A. infer the function(s) of a code that is searched (drawing a shadow)
         B. recall a case(s) with the same function (none exactly the same)
         C. generalize the function until a case with the same generalized function is found (drawing a line)
            i. interpret the function
            ii. eliminate the detail information of the function to be more general
            iii. recall a case(s) that uses the generalized function (drawing a box around an event information list, drawing a box around the special information in the Kim’s Kitchen page)
         D. recall the style code(s) that served the function for the two old cases. (‘border-style and border-color’)
         E. determine to use the style codes for the current task
   4. check the feasibility of using the code
      A. recall the rule of using the style codes, border-style and border-color (‘HTML elements for the boxes’{border-style and border-color: ‘dark color value’,})
      B. recognize that everything is identified

3. assign the style code with selected value
   A. identify the element that will be affected by the style (li and/or div element)
   B. recall the styling can affect to all the li elements
   C. interpret the style should affect to only the li elements of the main-menu not any other ordinary li elements
   D. recall to use the option, ‘class’ for limited application of a style
   E. determine to use the option, class
   F. recall that the class has been already made for the white boxes
   G. identify the class name (e.g.: menubar and contentbox)
   H. assign the style code,
      i. locate the style section for the white boxes with the class name
      ii. interpret drop shadow shows only part of the border line (e.g.: right side and bottom only)
      iii. determine to display only the right side and bottom side only
      iv. type it in (ul.menubar{border-right-style: solid; border-bottom-style: solid; border-right-color: grey; border-bottom-color: grey;} and div.contentbox{border-right-style: solid; border-bottom-style: solid; border-right-color: grey; border-bottom-color: grey;})

4. check the page display

5. evaluate the result

8. the image in the menu bar with a flexible height

...Also, can you make the height of the menu bar flexible too, so it is changeable depending on the number of menu items. I don’t know how much links will I have and it will be all different in each part, so I think it is very important to have a flexible height...
So, I want this image in the menu bar, so that the main-menus and 8 book titles will be on top of this image. However, keep in mind that the length of the menu changes in other parts. The shortest one is to show just 5 main-menus. On the other hand, the sub-menu can have countless number of items. So, please make sure the images look right regardless of the length of the menu bar.

My friend broke the picture up into two pieces, top (pen) and bottom (coffee cup), just in case. I don't know which one you have to use. You can download the picture from these links: pen picture, coffee cup picture, and the whole picture. Use any of these that you need to make the menu bar.

* pre-condition: You have all the text typed in the web-page from the task 1 (p.144). Also, the text has it's own structure (title, headings, paragraphs, lists, etc...) from the task 1, too. It is also assumed that the white menu bar is made already at the task 3 (p. 147). The rest of the tasks are not considered here, since the rest of the tasks are not necessarily in order.

* sub-goals for this task: 1. display the image on the menu bar with flexible height, 2. display the image right with long menu items

1. analyze the situation to set the sub-goal for the statement
   A. interpret the statement
   B. determine the sub-goal(s) of the statement (display the image on the menu bar with flexible height, and display the image right with long menu items)

2. generate a solution(s) for the first sub-goal
   A. infer conditions of the first sub-goal (display the top part of the image always on top of the menu bar, and display the bottom part of the image always at the bottom of the menu bar)
      i. interpret the sub-goal
      ii. infer the meaning of 'flexible' (moveable of the bottom part of the image along with the changing height of the menu bar)
      iii. determine that the top part of the image should be displayed always on top of the menu bar, and the bottom part of the image should be displayed always at the bottom of the menu bar
   B. generate a solution for each condition until application is feasible
      i. generate a solution(s) that meets the first condition, 'display the top part of the image always on top of the menu bar'
         1. recall the first condition of the sub-goal
         2. determine which one (CSS or HTML or both) to change or add more
            A. interpret the condition
            B. recognize the condition is decorative task
            C. classify the condition into decorative task
            D. recall that CSS is used for decorative task
            E. determine to use CSS for the task
      2. infer the function that would fulfill the condition
         A. infer the function(s) of a code that is searched (inserting an image at the top)
         B. recall a case(s) with the same function (inserting the little fans picture)
         C. recall the style code(s) that served the function for the old case. ('background-image')
         D. determine to use the style code for the current task
      3. check the feasibility of using the code
         A. recall the rule of using the style code, background-image ('HTML element name of the menu bar'{background-image: url('filename');})
         B. determine that it is feasible to apply the code
   ii. generate a solution(s) that meets the second condition, 'display the bottom part of the image always at the bottom of the menu bar'
      1. recall the second condition of the sub-goal
      2. determine which one (CSS or HTML or both) to change or add more
         A. interpret the condition
         B. recognize the condition is decorative task
         C. classify the condition into decorative task
         D. recall that CSS is used for decorative task
         E. determine to use CSS for the task
      3. infer the function that would fulfill the condition
         A. infer the function(s) of a code that is searched (inserting an image at the bottom)
         B. recall a case(s) with the same function (none exactly the same)
         C. generalize the function until a case with the same generalized function is found (inserting an image)
            i. interpret the function
            ii. eliminate the detail information of the function to be more general
               i. recall a case(s) that uses the generalized function (inserting the little fans picture)
            D. recall the style code(s) that served the function for the old case. ('background-image')
            E. determine to use the selected style code for the current task
      4. check the feasibility of using the code
         A. recall the rule of using the style code, background-image ('HTML element name of the menu bar'{background-image: url('filename');})
         B. recall that a background image is already inserted
C. interpret the background image allows only one file to be inserted
D. recall the pictures need to be broken into two, top and bottom, to be displayed with flexible height
E. infer the needs of another element to contain a picture at the same place
iii. infer to change the second condition into ‘display the bottom part of the image in an another element, located exactly at the same place as the menu bar, always at the bottom of the menu bar’
iv. generate a solution(s) that meets the adjusted second condition

1. recall the conditions of the sub-goal
2. determine which one (CSS or HTML or both) to change or add more
A. interpret the condition
B. recognize containing an element is structuring task
C. recall that the inserting decorative image is a styling task
D. classify the conditions into using both HTML and CSS tasks
E. determine to use both for the task
3. generate a solution(s) to make an element located exactly at the same place as the menu bar
A. infer the function(s) of an element that is searched (placing an element overlapping another element)
B. recall a case(s) with the same function (none exactly the same)
C. interpret the characteristics of an element (elements cannot be placed overlapped)
D. infer an alternative (an element can be inserted within an element)
E. infer the needs of acknowledgement of an element that can be inserted and located at the same place
F. infer the element that will include, and the element that will be inserted
i. recall the element that contains menu bar (ul)
ii. recall the position of the image (images should be placed behind the menu bar)
iii. infer that the ul element should be inserted, and the other element should include the ul element and a background image so the image will be displayed at the bottom)
G. recall (or identify from the reference table) an case of using an element that can include ul element (div for aligning an list element in the middle)
H. determine to use div element for overlapping
I. determine to use the style code, background-image, for the element

3. assign the selected code(s) and to the appropriate element(s)
A. assign the background-image style code
i. recall the newly determined style code rule (ul{background-image: url('filename');})
ii. recall the styling can affect to all the ul elements
iii. interpret the style should affect to only the menu list not any other ordinary lists
iv. recall to use the option, ‘class’ for limited application of a style
v. determine to use ‘class’
vi. recall that the class has been already made for the menu bar (e.g. ul.menubar)
vii. locate the style section for the element with the class name
viii. recall where the image file is stored in the computer
ix. type the style code in the style section (ul.menubar{background-image: url('filename');})
B. assign the div element
i. locate the element, div, (the list element containing menu bar)
ii. type the element tags (<div> the list element for the menu bar </div>)
C. assign the background-image style code to the div element
i. recall the styling can affect to all the div elements
ii. interpret the style should affect to only the div element containing the menu bar not any other div elements
iii. recall to use the option, ‘class’ for limited application of a style
iv. determine to use ‘class’
v. select a unique name (e.g. menubox)
vi. locate the div element
vii. recall the rule of making a class
viii. type the class name (<div class=menubox>)
ix. make a style section for the element (div.menubox){}
x. recall where the image file is stored in the computer
xi. type the style code in the style section (div.menubox{background-image: url('filename');})

4. check the page display
5. evaluate the result
A. recognize the menu items block most of the bottom picture
B. infer the needs making the menu bar a little bit longer than the menu items
C. recall the second sub-goal
D. infer the second sub-goal will solve the display problem

6. generate a solution(s) for the second sub-goal (display the image right with long menu items)
A. identify conditions of the sub-goal (be in different length for the bottom image and the menu items)
B. generate a solution for the condition until application is feasible
i. determine which one (CSS or HTML or both) to change or add more
1. interpret the condition
2. recognize the condition is a styling task
3. classify the conditions into CSS tasks
4. determine to use CSS for the task
ii. generate a solution(s) to display the bottom image lower than the menu items
1. infer the function(s) of an element that is searched (protecting the background image display)
2. recall a case(s) with the same function (none exist)
3. interpret the characteristics of an background image (background image cannot be protected because they meant to be displayed overlapped in nature)
4. infer an alternative way to protect (have enough empty space under the menu item, so the background image can be still displayed)
5. infer the needs of style codes to provide the empty space
6. recall (or identify from the reference table) a style code(s) to make an empty space (margin or padding)
7. determine to which one to use
   A. compare the two style code
      i. interpret each style code (make a space)
      ii. recall a case(s) that represents each style code (page margin, special box)
      iii. recognize the difference between the two (outside the line, inside the line)
8. determine to use the style code, margin, for the element
   iii. check the feasibility of using the code
1. recall the rule of using the style code, width (li.menubox{margin: ‘selected value’;})
2. determine it is feasible to assign the style code
7. assign the style code
   A. type it in (li.menubox{margin: ‘selected value’;})
8. check the page display
9. evaluate the result
APPENDIX G

DIFFERENT TYPES OF TRANSFER IDENTIFICATION BASED ON THE TASK ANALYSIS
Different Types of Transfer Identification Based on the Task Analysis

- **Code**: a HTML or CSS element (e.g., `ul`, ‘background-color’)
- **Principle**: a general rule of use of code (e.g., `ul` is a HTML element to grouping several list-items under one bigger category without any sequential order among list-items, ‘background-color’ is a CSS style code to assign a color to the area of any element)
- **Task**: a perceptual small broken-down action to make a web-page as desired (e.g., make a white menu bar that shows the 5 major parts of the web-site)
- **Condition**: specific requirement to accomplish a task (e.g., be a white menu bar, be a rectangular shape, contain the name of the 5 major parts)
- **Function**: a use within a context of a particular code for a particular purpose (e.g., frame of the entire page—note, the functions can be very general or very specific depends on the individual experience and/or specific purpose)
- **Case**: one instance of using a code
- **Simple Application**: use the same code for same functions with different value (same function, same element, different value)
- **Low-road Transfer**: use the same code for same functions with different conditions (same function, different element, value can be same or different)
- **High-road Transfer**: use the same code for different functions

<table>
<thead>
<tr>
<th>Code Name (with general principle)</th>
<th>Learned Function During the Instruction</th>
<th>Simple Application (same as the learned cases with different value)</th>
<th>Low-road Transfer (for the same function with different conditions)</th>
<th>High-road Transfer (for different functions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>background-color</strong> (defining a color of the content area of any element)</td>
<td>* web-page color - case: ‘Everything with Chocolate page’ * a special link background color - case: ‘author’s home page’ roll-over link</td>
<td>* web-page color with different color (test1) * web-page color (test2)</td>
<td>* color only outside the frame (test1) * menubar color by using a list element (test2) * main content area color using div element (test2) * solid color buttons (test2)</td>
<td></td>
</tr>
<tr>
<td><strong>background-image</strong> (defining image of the content area of any element with defined number of repetition in any direction)</td>
<td>* decorative border on top of the screen and a box (body) - case: ‘Kim’s Restaurant’ page, ‘specials’ box (div)</td>
<td></td>
<td>* decorative border inside of the frame only (test1) * decorative picture inside the list (test2)</td>
<td>* pictures overlapping (test2)</td>
</tr>
<tr>
<td><strong>border-style</strong> (defining an appearance of the edge around the content area of any element)</td>
<td>* a frame around the entire content - case: ‘Everything with Chocolate’ * a box around a list - case: list of event information * a box around the div element - case: special box in the Kim’s Restaurant page</td>
<td></td>
<td>* a frame around the div to draw a box for the entire content (test1)—you have to know to use div, not body element even though it is for the entire content</td>
<td>* drop-shadow of a main content area using div (test2) * drop-shadow of a menu bar using ul (test2)</td>
</tr>
<tr>
<td><strong>float</strong> (defining an position, either left or right without changing of an line, of an element with no preservation of left-over)</td>
<td>* an image placed next to its’ description (img) - case: chocolate picture and book description, favorite dish and its description</td>
<td>* a box with content next to other content (ul) (text2)</td>
<td></td>
<td>* two column</td>
</tr>
<tr>
<td>Property</td>
<td>Usage</td>
<td>Examples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>space on its other, left or right, side)</td>
<td>* a box with content next to other content (div) - case: specials in the Kim’s Restaurant page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>list-style-type</td>
<td>(defining the attributes and appearance of a starting point for each list-item)</td>
<td>* remove the bullet of a list-item - case: lists of restaurant information and hours of operation</td>
<td>* button text decoration (test2)</td>
<td></td>
</tr>
<tr>
<td>margin</td>
<td>(defining the amount of space outside of the border of an element on any side of the element)</td>
<td>* surrounding space outside the web-page frame to the edge of the screen - case: Everything with Chocolate web page frame</td>
<td>* main content area separating from the menu bar (test2) * top side image protection (test2) * buttons arranging bottom (test2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* side space between a box and other text (div, p) - case: special box and other text</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* side space between an image and text (img, p) - case: chocolate image and paragraph</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* line space between paragraph and heading (p, h3) - case: h3s and paragraphs in the Kim’s Restaurant page</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* width of a box (ul) - case: event information box</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* middle aligning of a entire page and a div element (div) - case: Kim’s Restaurant page, restaurant information list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>padding</td>
<td>(defining the amount of space from the content area to the border of an element on any side of the element)</td>
<td>* space between web-page frame and the entire content of the page - case: Everything with Chocolate web page frame</td>
<td>* space on top part of the frame only inside for the entire content (test1)—you have to acknowledge to control div element not the body element</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* space inside the box (ul) - case: event information box</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* space inside a box (div) - case: special box in the Kim’s Restaurant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>width</td>
<td>(defining the width of the border of any element)</td>
<td>* width of a box - case: special box for restaurant information</td>
<td>* buttons with same width (test2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* width of a box for the menu bar (test2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* width of a div element to fix the entire content with the width of 750px (test1)—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
<td>Example</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>div</td>
<td>a box contains text and images - case: special box in the Kim’s restaurant page</td>
<td>a box for the selected text (test 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>li</td>
<td>detail information - case: date, place, day, etc…</td>
<td>buttons of the web-page (test2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ul</td>
<td>a series of short information about the same topic - case: event information, restaurant information, hours of operation</td>
<td>main-menu (test2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>color</td>
<td>text color of the entire web-page - case: white color for the ‘Everything with Chocolate’ page</td>
<td>heading with different color (test1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>font-family</td>
<td>font type of defined text elements - case: times for h1 and h2</td>
<td>h1 with different type (test1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>font-size</td>
<td>defining the display size of any text-content in the body element</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>em</td>
<td>‘different’ text style in a paragraph - case: quotation of a book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>br</td>
<td>line breaking within a paragraph - case: quoted phrase at the book description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>img</td>
<td>informative images inserting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tag</strong></td>
<td><strong>Description</strong></td>
<td><strong>Attributes</strong></td>
<td><strong>Examples</strong></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>(displaying an image from a specified location where the image is stored)</td>
<td>- case: next to the heading, in a paragraph</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>a</code></td>
<td>(defining attribute of a specified text or image)</td>
<td>- a link (URL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: add a link to the ‘direction,’ ‘author’s home page,’ and ‘library home’</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Target of a special link</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: ‘author’s home page’ roll-over link</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>p</code></td>
<td>(defining the texts, images and its attributes containing detail description for a topic as a block of an element)</td>
<td>- the texts and images containing detail description for a topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* target of a paragraph width styling</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>h1</code></td>
<td>(defining the texts, images and its attributes representing of the entire web-page as a block of an element)</td>
<td>- defining the text and images representing of the entire web-page</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: h1 for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* target of a coloring and sizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>h2</code></td>
<td>(defining the texts, images and its attributes representing major different content of a web-page as a block of an element)</td>
<td>- defining the texts and images representing major different content of a web-page</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: h2 for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* target of a coloring and sizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>h3</code></td>
<td>(defining the texts, images and its attributes representing next smaller different content of a h2 element)</td>
<td>- defining the texts and images representing next smaller different content of a h2 element</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: h3 for the ‘Kim’s Restaurant page’</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* target of a coloring and sizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>body</code></td>
<td>(defining all the content and its attributes that is displayed on the internet browser)</td>
<td>- all the content</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- a target of a frame around the entire content</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: both web pages for the instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>style</code></td>
<td>(defining all the information about styling of the body element)</td>
<td>- styling information of the body element</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- case: for both pages</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>title</code></td>
<td></td>
<td>- the page title on top of the internet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(defining the page title on top of the internet browser window)</td>
<td>browser window - case: for both pages</td>
<td>instruction with different title text</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>head</strong> (defining all the informative components about the web-page)</td>
<td>* defining all the informative components about the web-page - case: for both pages</td>
<td>* same function as the instruction with different content of style section</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>html</strong> (defining all the components to create web-page)</td>
<td>* defining all the components to create web-page - case: for both pages</td>
<td>* same function as the instruction with different content of head and body section</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H

RECRUITMENT ADVERTISEMENTS FOR DIFFERENT COMPENSATIONS
Learn how to make web pages using HTML and CSS start from scratch! You do not need expensive authoring tool to develop web pages. All you need is any text editor in your computer and your powerful mind!

This is an online tutorial that is part of a doctoral study at Penn State to examine the effect of generalizing abstraction activities in online situated learning.

In the tutorial, you will learn how to use HTML and CSS elements to make web pages. After each activity, you will be asked to submit your work. You don’t have to finish the tutorial at one time. You can visit the site at your convenient time as often as you want. However, you will be asked to complete the study within 1 week. You will be asked to register with your student id and a password. Once you register the site will remember your progress and show the tutorial accordingly.

Once you complete the tutorial, you will be able to make web pages that are clean and stable without using any expensive authoring software. Clean coding is one of the desirable skills that you can show as a web page developer both in general and professional and it is also recommended by the World Wide Web Consortium (W3C).

You must be 18 or older. You are not required to have any prior web page development experience to take the tutorial. However, since this is an online tutorial, you will be expected to have internet access. Also, the investigator would like to inform you that if you can make the type of page structure below with simple hand coding already, the tutorial may not meet your interests. (Bigger size images are available at the web site.)

This study is voluntary and no personal identification information will be collected. You can stop participating in the study at any point. You will not be asked or contacted for it nor will your data be used.

Your participation will help to examine effective ways of teaching in online situated learning environment.

In case of questioning or commenting about the study, please contact the Investigator, Jiyeon Ryu (jxr42@psu.edu) at any time. You can also visit the web site (http://www.isdlink.org/ae) to learn more about the study and if you decide to participate in the study you can register at the web site.
Learn how to make web pages using HTML and CSS start from scratch! You don’t need expensive authoring tool to develop web pages. All you need is any text editor in your computer and your powerful mind!

This is an online tutorial that is part of a doctoral study at Penn State to examine the effect of generalizing abstraction activities in online situated learning.

In the tutorial, you will learn how to use HTML and CSS elements to make web pages. After each activity, you will be asked to submit your work. You don’t have to finish the tutorial at one time. You can visit the site at your convenient time as often as you want. However, you will be asked to complete the study within 1 week. You will be asked to register with your student id and a password. Once you register, the site will remember your progress and show the tutorial accordingly.

Once you complete the tutorial, you will be able to make web pages that are clean and stable without using any expensive authoring software. Clean coding is one of the desirable skills that you can show as a web page developer both in general and professional and it is also recommended by the World Wide Web Consortium (W3C).

You must be 18 or older. You are not required to have any prior web page development experience to take the tutorial. However, since this is an online tutorial, you will be expected to have internet access. Also, the investigator would like to inform you that if you can make the type of page structure below with simple hand coding already, the tutorial may not meet your interests. (Bigger size images are available at the web site. No registration is needed to see the pictures.)

This study is voluntary and no personal identification information will be collected other than your student id. You can stop participating in the study at any point. You will not be asked or contacted for it nor will your data be used. Your participation will help to examine effective ways of teaching in online situated learning environment.

Once you complete the study, your student id will be sent automatically to Dr. Harkness, so you do not have to do any further action.

In case of questioning or commenting about the study, please contact the Investigator, Jiyeon Ryu (jxr42@psu.edu) at any time. You can also visit the web site (http://www.isdlink.org/af) to learn more about the study and if you decide to participate in the study you can register at the web site. If your browser is set to block pop-up window, you can either click the link “Open in a New Window” or visit the page directly to http://isdlink.org/af/gate.cgi?target=p1h0mv1lartg-welcome.
Learn how to make web pages using HTML and CSS start from scratch! You don’t need expensive authoring tool to develop web pages. All you need is any text editor in your computer and your powerful mind!

This is an online tutorial that is part of a doctoral study at Penn State to examine the effect of generalizing abstraction activities in online situated learning.

In the tutorial, you will learn how to use HTML and CSS elements to make web pages. After each activity, you will be asked to submit your work. You don’t have to finish the tutorial at one time. You can visit the site at your convenient time as often as you want. However, you will be asked to complete the study within 1 week. You will be asked to register with your student id and a password. Once you register, the site will remember your progress and show the tutorial accordingly.

Once you complete the tutorial, you will be able to make web pages that are clean and stable without using any expensive authoring software. Clean coding is one of the desirable skills that you can show as a web page developer both in general and professional and it is also recommended by the World Wide Web Consortium (W3C).

You must be 18 or older. You are not required to have any prior web page development experience to take the tutorial. However, since this is an online tutorial, you will be expected to have internet access. Also, the investigator would like to inform you that if you can make the type of page structure below with simple hand coding already, the tutorial may not meet your interests. (Bigger size images are available at the web site. No registration is needed to see the pictures.)

This study is voluntary and no personal identification information will be collected other than your student id. You can stop participating in the study at any point. You will not be asked or contacted for it nor will your data be used. Your participation will help to examine effective ways of teaching in online situated learning environment.

Once you complete the study, you will be given cash ($10) as a way of appreciation. You will receive an e-mail for the schedule and place of the payment.

In case of questioning or commenting about the study, please contact the Investigator, Jiyeon Ryu (jxr42@psu.edu) at any time. You can also visit the web site (http://www.isdlink.org/ag) to learn more about the study and if you decide to participate in the study you can register at the web site. If your browser is set to block pop-up window, you can either click the link “Open in a New Window” or visit the page directly to http://isdlink.org/ag/gate.cgi?target=p1h0mv11artg-welcome.
APPENDIX I

INFORMED CONSENT FORM FOR THE DIFFERENT COMPENSATIONS
Implied Informed Consent Form for Social Science Research
The Pennsylvania State University

Title of Project: The Effect of Different Types of Activities in Online Situated Learning

Principal Investigator: Jiyeon Ryu, Graduate Student
304 Keller Building Building
University Park, PA 16802
(814) 867-6105; jxr42@psu.edu

Advisor: Dr. Barbara Grabowski
304 E Keller Building
University Park, PA 16802
(814) 865-0128; bgrabowski@psu.edu

1. Purpose of the Study: The purpose of this study is to investigate the effective learning activities in on-line learning environment.

2. Procedures to be followed: You will be asked to make your own id and password just for this study and register only with those id and password. Please do not make your id based on personal information that could give any hint about your identification (e.g. your name, student id number, etc.). However, select your id and password that is easy to remember. Once you register successfully you will be asked about your prior web experience if you have any. You will also be asked to answer a series of questions about using document software. In the actual tutorial, you will learn about how to make web pages using HTML and CSS elements. You will be given two web page making situations and you will be asked to follow a series of instructions. You will also be asked to submit activities that you have done from time to time and web-page coding that you have worked. After you have completed the tutorial, you will be asked to develop two web pages and submit the coding.

3. Risks/Discomforts: You may feel social isolation caused by individual online learning environment. Also, you may feel fatigue, disorientation caused by sitting in front of a computer for a long time and active mental activities. The investigator advises you to take a break as often as you need and do social activities. You can continue the program later at your own convenient time(s) and place within limited period (7 days). Your id will remember where you were last time and provide instructions accordingly.

4. Benefits: Once you complete the tutorial, you will be able to make web pages that are clean and stable without using any expensive authoring software. Clean coding is one of the desirable skills that is required as a web-page developer and it is also recommended by the World Wide Web Consortium (W3C). You will also be able to understand how web page is constructed and how they are displayed on your computer screen. Also, by participating this study, you will be able to contribute to design and develop the effective online learning materials to support learners better.

5. Duration: It will take about 5 hours to complete the tutorial without stopping. However, since you are allowed to leave the site and come back at your convenient time, the actual completion time can vary.

6. Statement of Confidentiality: The web site does not ask for any information that would identify who the responses belong to during the whole time. Please do not share your id with others, which may impact your own progress. However, confidentiality will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared because no personal information is collected. Neither your id that you used in the study will be used. The following may review and copy records related to this research: The Office of Human Research Protections in the U.S. Department of Health and Human Services, Penn State University’s Social Science Institutional Review Board, and Penn State University’s Office for Research Protections.
7. **Right to Ask Questions:** You can ask questions about this research. Contact Jiyeon Ryu (jxr42@psu.edu) at (814) 867-6105 with questions. You can also contact the investigator using “send message” in the web site, once you log in. The investigator has only your id information and no other information about your identification. Consequently investigator will answer to the id, so only the person with the id can check the message that way, you do not have to reveal any other personal identifiable information. You can call this number if you have complaints or concerns about this research. If you have questions about your rights as a research participant, or you have concerns or general questions about the research, contact Penn State University’s Office for Research Protections at (814) 865-1775. You may also call this number if you cannot reach the research team or wish to talk to someone else.

8. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. Refusal to take part in or withdraw from this research will involve no penalty or loss of benefits you would receive otherwise or are entitled.

You must be 18 years of age or older to take part in this research study.

Pressing the “Agree” button and completing and returning the computer-based assignment you are implying your voluntary consent to participate in this research. Please print this form to keep for your records. If you don’t have access to a printer right now, you can visit this page later when you log in next time and print it.

*This informed consent form (IRB#24431, Doc. #1) was reviewed and approved by the Office for Research Protections or Social Science Institutional Review Board at The Pennsylvania State University on 02-05-2007. It will expire on 11-28-2007. DWM*
Title of Project: The Effect of Different Types of Activities in Online Situated Learning

Principal Investigator: Jiyeon Ryu, Graduate Student
304 Keller Building
University Park, PA 16802
(814) 867-6105; jxr42@psu.edu

Advisor: Dr. Barbara Grabowski
304 E Keller Building
University Park, PA 16802
(814) 865-0128; bgl104@psu.edu

1. **Purpose of the Study:** The purpose of this research study is to investigate the effective learning activities in online learning environment.

2. **Procedures to be followed:** You will use a tutorial to create a web-page in this study. First, you will be asked to register the site. Use your PSU user-id to register so that you can be validated for extra credits later. It is important to use correct PSU user-id. Misspelled id cannot be corrected after study completion. However you are not required to use your password that you are currently using in your school. It is safer to use a new password just for this study purpose. Also, make sure that you remember your password so that you can visit the site next time. Because once you register, you can access the site with your student id as often as you want at your convenient time and place(s) within limited period (7 days). Your id will remember where you were last time and provide instructions accordingly. When you sign-in the site, you will be asked about your prior web experience if you have any. You will also be asked to answer a series of questions about using document software and HTML and CSS. In the actual tutorial, you will learn about how to make web pages using HTML and CSS elements. You will be given two web page making situations and you will be asked to follow a series of instructions. You will also be asked to submit the activities that you have done from time to time. After you have completed the tutorial, you will be asked to develop and submit a web page that meets the requirements in two different situations as final tests.

3. **Risks/Discomforts:** You may feel social isolation caused by individual online learning environment. Also, you may feel fatigue, disorientation caused by sitting in front of a computer for a long time and active mental activities. The investigator advises you to take a break as often as you need and do social activities.

4. **Benefits:** Once you complete the tutorial, you will be able to make simple web-pages that are clean and stable without using any expensive authoring software. Clean coding is one of the desirable skills that you can show as a web page developer both in general and professional and it is also recommended by the World Wide Web Consortium (W3C). You will also be able to understand how web page is constructed and how they are displayed on your computer screen. Also, your participation to this study will contribute to the design and development of the effective online learning materials to support learners better.

5. **Duration:** It will take about 5 hours to complete the tutorial without stopping. However, since this is self-paced instruction, depends on your pace the actual completion time may vary.

6. **Statement of Confidentiality:** The web site does not ask for any personal identifiable information other than your student id number. Please do not share your id and password with others, which may impact your own progress. Confidentiality will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. In the event of any publication or presentation resulting from the research, no personally identifiable information will be used. The following may review and copy records related to this research: The Office of Human Research Protections in the U.S. Department of Health and Human Services, Penn State University’s Social Science Institutional Review Board, and Penn State University’s Office for Research Protections.
7. **Right to Ask Questions:** You can ask questions about this research. Contact Jiyeon Ryu (jxr42@psu.edu) at (814) 867-6105 with questions. You can also contact the investigator using “send message” in the web site, once you log in. The investigator has only your id information and no other information about your identification. Consequently investigator will answer to the id, so only the person with the id can check the message that way, you do not have to reveal any other personal identifiable information. You can call this number if you have concerns about this research or if you feel that you have been harmed by this study. If you have questions about your rights as a research participant, or you have concerns or general questions about the research, contact Penn State University’s Office for Research Protections at (814) 865-1775. You may also call this number if you cannot reach the research team or wish to talk to someone else.

8. **Payment for Participation:** Participants will receive 30 extra credit points for their STAT 200 course upon their completion of the study. When you submit the two final web pages, your student id will be automatically sent to your professor. So, you do not need to do any further action. There is another option to participating to receive the same amount of extra credit points. This option is to watch series of video tape, called “Against All Odds,” explaining about statistical concepts. You will be asked to watch 10 video tapes and take a quick 20 items multiple choice test. It will take all together about 5 hours. To get more detail information about location and schedule for video watching, contact professor Harkness.

9. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. Refusal to take part in or withdraw from this research will involve no penalty or loss of benefits you would receive otherwise or are entitled.

You must be 18 years of age or older to take part in this research study.

Pressing the “Agree” button and completing and returning the computer-based assignment you are implying your voluntary consent to participate in this research. Please print this form to keep for your records. If you don’t have access to a printer right now, you can save this page and print it later.

*This informed consent form (IRB# 24431, Doc. #1) was reviewed and approved by the Office for Research Protections or Social Science Institutional Review Board at The Pennsylvania State University on 02-26-2007. It will expire on 11-28-2007. DWM*
Title of Project: The Effect of Different Types of Activities in Online Situated Learning

Principal Investigator: Jiyeon Ryu, Graduate Student
304 Keller Building
University Park, PA 16802
(814) 867-6105; jxr42@psu.edu

Advisor: Dr. Barbara Grabowski
304 E Keller Building
University Park, PA 16802
(814) 865-0128; bg1104@psu.edu

1. Purpose of the Study: The purpose of this research study is to investigate the effective learning activities in on-line learning environment.

2. Procedures to be followed: You will use a tutorial to create a web-page in this study. First, you will be asked to register the site with your PSU user-id a password. You id will be used for validation for cash reward later. It is important to use correct student id. Misspelled id cannot be validated after study completion. You are not required to use your password that you are currently using in your school. It is safer to use a new password just for this study purpose. Also, make sure that you remember your password so that you can visit the site next time. Because once you register, you can access the site with your student id as often as you want at your convenient time and place(s) within limited period (7 days). Your id will remember where you were last time and provide instructions accordingly. When you sign-in the site, you will be asked about your prior web experience if you have any. You will also be asked to answer a series of questions about using document software and HTML and CSS. In the actual tutorial, you will learn about how to make web pages using HTML and CSS elements. You will be given two web page making situations and you will be asked to follow a series of instructions. You will also be asked to submit the activities that you have done from time to time. After you have completed the tutorial, you will be asked to develop and submit a web page that meets the requirements in two different situations as final tests.

3. Risks/Discomforts: You may feel social isolation caused by individual online learning environment. Also, you may feel fatigue, disorientation caused by sitting in front of a computer for a long time and active mental activities. The investigator advises you to take a break as often as you need and do social activities.

4. Benefits: Once you complete the tutorial, you will be able to make simple web-pages that are clean and stable without using any expensive authoring software. Clean coding is one of the desirable skills that you can show as a web page developer both in general and professional and it is also recommended by the World Wide Web Consortium (W3C). You will also be able to understand how web page is constructed and how they are displayed on your computer screen. Also, your participation to this study will contribute to the design and development of the effective online learning materials to support learners better.

5. Duration: It will take about 5 hours to complete the tutorial without stopping. However, since this is self-paced instruction, depends on your pace the actual completion time may vary.

6. Statement of Confidentiality: The web site does not ask for any personal identifiable information other than your student id number. Please do not share your id and password with others, which may impact your own progress. Confidentiality will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. In the event of any publication or presentation resulting from the research, no personally identifiable information will be used. The following may review and copy records related to this research: The Office of Human Research Protections in the U.S. Department of Health and Human Services, Penn State University’s Social Science Institutional Review Board, and Penn State University’s Office for Research Protections.
7. **Right to Ask Questions:** You can ask questions about this research. Contact Jiyeon Ryu (jxr42@psu.edu) at (814) 867-6105 with questions. You can also contact the investigator using “send message” in the web site, once you log in. The investigator has only your id information and no other information about your identification. Consequently investigator will answer to the id, so only the person with the id can check the message that way, you do not have to reveal any other personal identifiable information. You can call this number if you have concerns about this research or if you feel that you have been harmed by this study. If you have questions about your rights as a research participant, or you have concerns or general questions about the research, contact Penn State University’s Office for Research Protections at (814) 865-1775. You may also call this number if you cannot reach the research team or wish to talk to someone else.

8. **Payment for Participation:** Participants will receive $10 cash upon their completion of the study. Once the study is finished all the participants who completed their study will be sent an e-mail about payment schedule. The payment will take place at your STAT 200 class (lab time) for your convenience.

9. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. Refusal to take part in or withdraw from this research will involve no penalty or loss of benefits you would receive otherwise or are entitled.

You must be 18 years of age or older to take part in this research study.

Pressing the “Agree” button and completing and returning the computer-based assignment you are implying your voluntary consent to participate in this research. Please print this form to keep for your records. If you don’t have access to a printer right now, you can save this page and print it later.

*This informed consent form (IRB# 24431, Doc. #2) was reviewed and approved by the Office for Research Protections or Social Science Institutional Review Board at The Pennsylvania State University on 02-26-2007. It will expire on 11-28-2007. DWM*
APPENDIX J

W3C GUIDELINES FOR THE TRANSFER CHECKLIST
W3C Guidelines

Selected Check Points from the Original Checklist

* Original Source: Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0 (W3C, 1999a)
  (See the related techniques below for more information about each check point)

2.1 Ensure that all information conveyed with color is also available without color, for example from context or markup.

2.2 Ensure that foreground and background color combinations provide sufficient contrast when viewed by someone having color deficits or when viewed on a black and white screen. [Priority 2 for images, Priority 3 for text].

3.1 When an appropriate markup language exists, use markup rather than images to convey information.

3.3 Use style sheets to control layout and presentation.

3.4 Use relative rather than absolute units in markup language attribute values and style sheet property values.

3.5 Use header elements to convey document structure and use them according to specification.

3.6 Mark up lists and list items properly.

3.7 Mark up quotations. Do not use quotation markup for formatting effects such as indentation.

5.3 Do not use tables for layout unless the table makes sense when linearized. Otherwise, if the table does not make sense, provide an alternative equivalent (which may be a linearized version).

6.1 Organize documents so they may be read without style sheets. For example, when an HTML document is rendered without associated style sheets, it must still be possible to read the document.

12.3 Divide large blocks of information into more manageable groups where natural and appropriate.

13.1 Clearly identify the target of each link.

Selected Check Points and the Related Techniques

* Original Source: Core Techniques for Web Content Accessibility Guidelines 1.0 (W3C, 2000a), HTML Techniques for Web Content Accessibility Guidelines 1.0 (W3C, 2000c), and CSS Techniques for Web Content Accessibility Guidelines 1.0 (W3C, 2000b)

2.1 Ensure that all information conveyed with color is also available without color, for example from context or markup.

- HTML content developers should use the HTML 4.01 [HTML4] heading elements (H1-H6) to identify new sections. These may be complemented by visual or other cues such as horizontal rules, but should not be replaced by them.
- Content developers should not use structural elements to achieve presentation effects. For instance in HTML, even though the BLOCKQUOTE element may cause indented text in some browsers, it is designed to identify a quotation, not create a presentation side-effect. BLOCKQUOTE elements used for indentation confuse users and search robots alike, who expect the element to be used to mark up block quotations.
- Ensure that information is not conveyed through color alone. For example, when asking for input from users, do not write “Please select an item from those listed in green.” Instead, ensure that information is available through other style effects (e.g., a font effect) and through context (e.g., comprehensive text links). For example…
  - Use a border.
  - use a different background color.
  - begin with the word that describe, such as “Example” or “Summary”.

2.2 Ensure that foreground and background color combinations provide sufficient contrast when viewed by someone having color deficits or when viewed on a black and white screen. [Priority 2 for images, Priority 3 for text].

- Use numbers, not names, for colors
- Ensure that foreground and background colors contrast well. If specifying a foreground color, always specify a background color as well (and vice versa).

3.1 When an appropriate markup language exists, use markup rather than images to convey information.

- Use style sheets to format text and control layout. Also, avoid using images to represent text -- use text and style sheets instead.
3.3 Use style sheets to control layout and presentation.

- Use the CSS ‘font’ property instead of the HTML FONT element to control font styles.
- HTML content developers should use the HTML 4.01 [HTML4] heading elements (H1-H6) to identify new sections. These may be complemented by visual or other cues such as horizontal rules, but should not be replaced by them.
- Content developers should not use structural elements to achieve presentation effects. For instance in HTML, even though the BLOCKQUOTE element may cause indented text in some browsers, it is designed to identify a quotation, not create a presentation side-effect. BLOCKQUOTE elements used for indentation confuse users and search robots alike, who expect the element to be used to mark up block quotations.
- The proper HTML elements should be used to mark up emphasis: EM and STRONG. The B and I elements should not be used; they are used to create a visual presentation effect. The EM and STRONG elements were designed to indicate structural emphasis that may be rendered in a variety of ways (font style changes, speech inflection changes, etc.)
- Content developers should use style sheets to style text rather than representing text in images.
- Indentation: ‘text-indent’. Do not use the BLOCKQUOTE or any other structural element to indent text.
- Layout, positioning, layering, and alignment should be done through style sheets (notably by using CSS floats and absolute positioning):
  - ‘margin’, ‘margin-top’, ‘margin-right’, ‘margin-bottom’, ‘margin-left’. With these properties, authors can create space on four sides of an element’s content instead of adding non-breaking spaces (&nbsp;).
  - ‘float’, ‘position’, ‘top’, ‘right’, ‘bottom’, ‘left’. With these properties, the user can control the visual position of almost any element in a manner independent of where the element appears in the document. Authors should always design documents that make sense without style sheets (i.e., the document should be written in a “logical” order) and then apply style sheets to achieve visual effects. The positioning properties may be used to create margin notes (which may be automatically numbered), side bars, frame-like effects, simple headers and footers, and more.

3.4 Use relative rather than absolute units in markup language attribute values and style sheet property values.

- Use relative rather than absolute units in markup language attribute values and style sheet property values. [Priority 2] For example, in CSS, use ‘em’ or percentage lengths rather than ‘pt’ or ‘cm’, which are absolute units. If absolute units are used, validate that the rendered content is usable.
- CSS Techniques
  - Use the “em” unit to set font sizes.
  - Use relative length units and percentages. CSS allows you to use relative units even in absolute positioning. Thus, you may position an image to be offset by “3em” from the top of its containing element. This is a fixed distance, but is relative to the current font size, so it scales nicely.
  - Only use absolute length units when the physical characteristics of the output medium are known, such as bitmap images.

3.5 Use header elements to convey document structure and use them according to specification.

- In HTML, use H2 to indicate a subsection of H1. Do not use headers for font effects.
- HTML content developers should use the HTML 4.01 [HTML4] heading elements (H1-H6) to identify new sections. These may be complemented by visual or other cues such as horizontal rules, but should not be replaced by them.
- Content developers should not use structural elements to achieve presentation effects. For instance in HTML, even though the BLOCKQUOTE element may cause indented text in some browsers, it is designed to identify a quotation, not create a presentation side-effect. BLOCKQUOTE elements used for indentation confuse users and search robots alike, who expect the element to be used to mark up block quotations.
- Sections should be introduced with the HTML heading elements (H1-H6). Other markup may complement these elements to improve presentation (e.g., the HR element to create a horizontal dividing line), but visual presentation is not sufficient to identify document sections.
Since some users skim through a document by navigating its headings, it is important to use them appropriately to convey document structure. Users should order heading elements properly. For example, in HTML, H2 elements should follow H1 elements, H3 elements should follow H2 elements, etc. Content developers should not “skip” levels (e.g., H1 directly to H3). Do not use headings to create font effects; use style sheets to change font styles for example.

3.6 Mark up lists and list items properly.

- HTML content developers should use the HTML 4.01 [HTML4] heading elements (H1-H6) to identify new sections. These may be complemented by visual or other cues such as horizontal rules, but should not be replaced by them.
- Content developers should not use structural elements to achieve presentation effects. For instance in HTML, even though the BLOCKQUOTE element may cause indented text in some browsers, it is designed to identify a quotation, not create a presentation side-effect. BLOCKQUOTE elements used for indentation confuse users and search robots alike, who expect the element to be used to mark up block quotations.
- The HTML list elements DL, UL, and OL should only be used to create lists, not for formatting effects such as indentation. Refer to information on CSS and tables for layout in the CSS Techniques [WCAG10-CSS-TECHNIQUES].
- HTML Techniques
  - Ordered lists help non-visual users navigate. Non-visual users may “get lost” in lists, especially in nested lists and those that do not indicate the specific nest level for each list item. Until user agents provide a means to identify list context clearly (e.g., by supporting the ‘:before’ pseudo-element in CSS2), content developers should include contextual clues in their lists.
  - For numbered lists, compound numbers are more informative than simple numbers. Thus, a list numbered “1, 1.1, 1.2, 1.2.1, 1.3, 2, 2.1,” provides more context than the same list without compound numbers, which might be formatted as follows:

    1.
    1.1
    1.2
    1.2.1
    1.3
    2
    2.1

  - Until either CSS2 is widely supported or user agents allow users to control rendering of lists through other means, authors should consider providing contextual clues in unnumbered nested lists. Non-visual users may have difficulties knowing where a list begins and ends and where each list item starts. For example, if a list entry wraps to the next line on the screen, it may appear to be two separate items in the list. This may pose a problem for legacy screen readers.
  - To change the “bullet” style of unordered list items created with the LI element, use style sheets. In CSS, it is possible to specify a fallback bullet style (e.g., ‘disc’) if a bullet image cannot be loaded.
  - Content developers should avoid list styles where bullets provide additional (visual) information. However, if this is done, be sure to provide a text equivalent describing meaning of the bullet:

3.7 Mark up quotations. Do not use quotation markup for formatting effects such as indentation.

5.3 Do not use tables for layout unless the table makes sense when linearized. Otherwise, if the table does not make sense, provide an alternative equivalent (which may be a linearized version).

- Layout, positioning, layering, and alignment should be done through style sheets (notably by using CSS floats and absolute positioning):
  - ‘margin’, ‘margin-top’, ‘margin-right’, ‘margin-bottom’, ‘margin-left’. With these properties, authors can create space on four sides of an element’s content instead of adding non-breaking spaces (&nbsp).
  - ‘float’, ‘position’, ‘top’, ‘right’, ‘bottom’, ‘left’. With these properties, the user can control the visual position of almost any element in a manner independent of where the element appears in the document. Authors should always design documents that make sense without style sheets (i.e., the document should be written in a “logical” order) and then apply style sheets to achieve visual effects. The positioning properties may be used to create margin notes (which may be automatically numbered), side bars, frame-like effects, simple headers and footers, and more.
6.1 Organize documents so they may be read without style sheets. For example, when an HTML document is rendered without associated style sheets, it must still be possible to read the document.

- When content is organized logically, it will be rendered in a meaningful order when style sheets are turned off or not supported.
- Provide a text equivalent for any important image or text generated by style sheets (e.g., via the ‘background-image’, ‘list-style’, or ‘content’ properties).
- Rules and borders may convey the notion of “separation” to visually enabled users but that meaning cannot be inferred out of a visual context.
- Using the positioning properties of CSS2, content may be displayed at any position on the user’s viewport. The order in which items appear on a screen may be different than the order they are found in the source document. The following example demonstrates a few principles:
  - the text appears visually in the browser in a different order than in the markup.
  - CSS positioning may be used to create tabular effects. A TABLE element could have been used to create the same effect.
- When style sheets are applied, it looks as it did before. However, now when the style sheets are not applied, the text appears in a definition list rather than a string of words. What appear as column headings when style sheets are applied, appear as defined terms when style sheets are not applied as demonstrated in the following screen shot.

12.3 Divide large blocks of information into more manageable groups where natural and appropriate.

- Nest lists with UL, OL, and DL.
- Use section headings (H1 - H6) to create structured documents and break up long stretches of text. Refer to the following section for more information.
- Break up lines of text into paragraphs (with the P element).
- All of these grouping mechanisms should be used when appropriate and natural, i.e., when the information lends itself to logical groups. Content developers should not create groups randomly, as this will confuse all users.

13.1 Clearly identify the target of each link.

- Good link text should not be overly general; do not use “click here.” Not only is this phrase device-dependent (it implies a pointing device) it says nothing about what is to be found if the link if followed. Instead of “click here”, link text should indicate the nature of the link target, as in “more information about sea lions” or “text-only version of this page”. Note that for the latter case (and other format- or language-specific documents), content developers are encouraged to use content negotiation instead, so that users who prefer text versions will have them served automatically. In addition to clear link text, content developers may specify a value of the “title” attribute that clearly and accurately describes the target of the link.
- In addition to clear link text, content developers may specify a value of the “title” attribute that clearly and accurately describes the target of the link.
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