

CHAPTER II

LITERATURE REVIEW

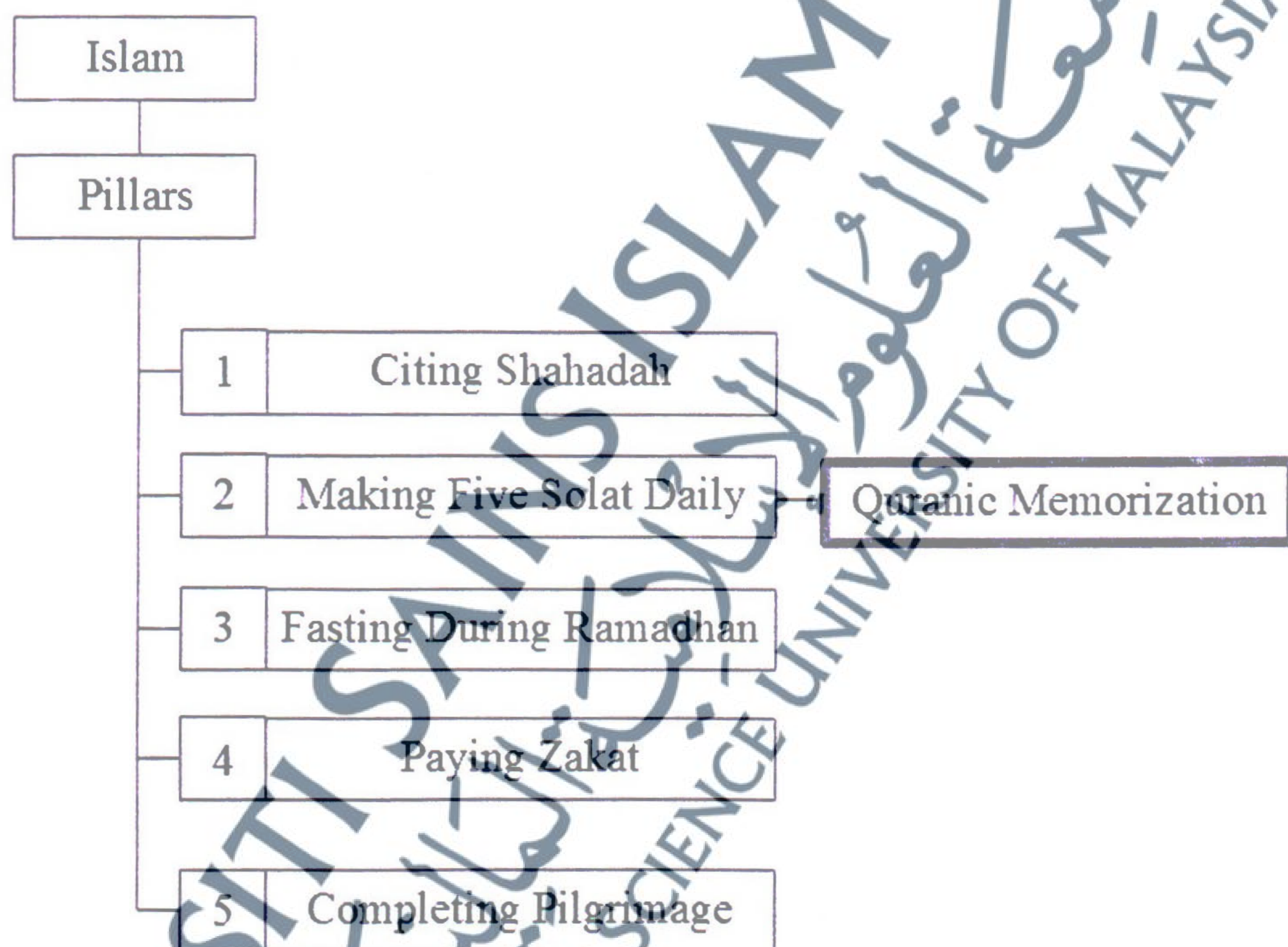
2.1 Introduction

The chapter begins with the role and importance of memorizing the Quran (Ariffin et al., 2013) from the aspect of Islam. This creates a culture of memorization among children at an early age. Although the importance is there, children may find it difficult to commit Quran to memory without proper aid. Thus, a comprehensive review must first be made on memory and how it works. Both memory types, the verbatim and semantic memory, are important in the memorization of the Quran. Verbatim memory is crucial in striving for an exact emulation of the Quran without any kind of distortion. On the other hand, semantic memory consolidates the stability of memory with understanding. This allows a stronger impression of memory through time. Knowledge on memory can be further amplified by studying the models of memory such as the multi-store memory model and the working memory model. Both are essential in uncovering the critical mechanism of effective encoding and retrieval. Memory can be enhanced by strategic educational approaches. The cognitive theory of multimedia learning systematically enumerates a collection of principles that can help to achieve the optimization of memory in learning. Using the ADDIE model (Cheng, K. W, 2011) from an instructional design, a proper lesson on Quranic memorization can be devised for the students. With sufficient technological support, it is possible to transform the lesson into an e-learning application. This would encourage the students to memorize the Quran on a frequent basis throughout their lives.

2.2 Quranic Memorization

In Islam, there are five pillars of religion (Faruqi, 2007) that must be performed by all Moslems (Figure 2.1). They are citing the shahadah (admitting that there is no God but Allah and the prophet Muhammad pbuh is His messenger), making five prayers daily, fasting during the month of Ramadhan, paying the zakat and last but not least, completing the pilgrimage in Mecca.

Figure 2.1: Pillars of islam and quranic memorization



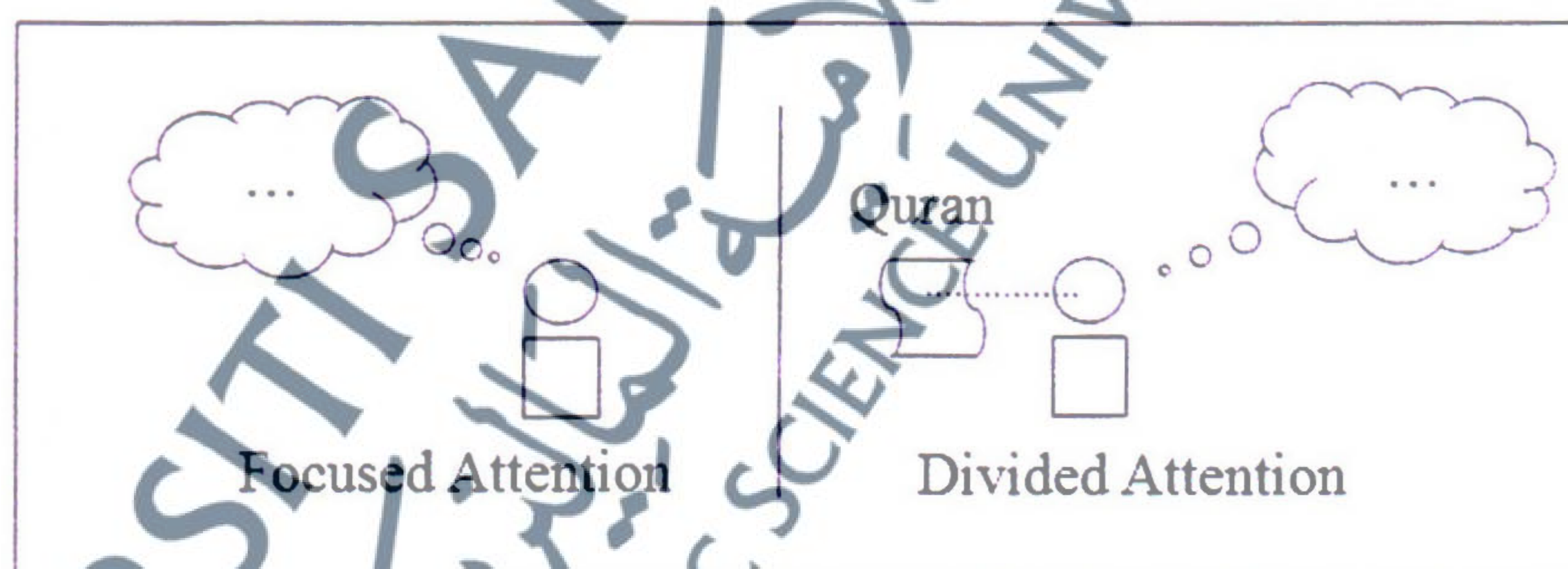
Practicing the five solat requires the Moslems to indulge in physical and mental submission in accordance with the manner defined by Islam. In doing so, they must recite a series of sentences from the Quran. To quote, surah Al-Fatihah is compulsory for the prayers. It must be recited in every rakaat of the prayers to make them valid.

Following Al-Fatihah, other surah can be read.

Given the importance of citing a collection of surah in performing the solat, it is therefore critical that the sentences are committed to memory (Md. Sawari & Awang Mat, 2014). Although they are certain practices whereby the Quran is referred upon actively during the prayers, knowing the surah by heart would encourage the process of achieving better concentration as a whole.

To illustrate the role of memorization in retaining concentration, consider the scenario of two people performing prayers separately as shown in (Figure 2.2). The first person memorizes the holy verses while the second looks at the Quran periodically to be reminded of what comes next. Between them, who can remain focus more easily? The former can direct his thoughts solely on the verses while the second must divide his attention between vision and cogitation, thus, gaining lesser concentration.

Figure 2.2: Memorized vs Non - Memorized Quran in Prayers



Concentration promotes the cultivation of complete humility and submission in solat (Othman et al., 2015). These two traits are highly commendable in Islam. In the first nine verses of the Surah Al-mukminun, the 23rd surah of the Quran, God promises the highest heaven named Firdaus to those with a set of characteristics. Being humble and submissive in prayers is one of them.

Now, memorizing the Quran is not just essential for solat, it is also needed for certain doa to take place. For instance, it is recommended that when a Moslem is having an intense emotional anxiety upon facing certain people of violence, he should pray to God for relief as shown in (Figure 2.3). This emulates the practice which had been granted from God to Moses when facing the endless victimization of the cruel pharaoh (Petrovich, 2006) to his own people.

Figure 2.3: Moses' prayer in facing difficult people

20.25: [Moses] said, "My Lord, expand for me my breast [with assurance]
 20.26: And ease for me my task
 20.27: And untie the knot from my tongue
 20.28: That they may understand my speech

The benefit of Quran transcends immediate benefit as shown previously. It can also improve mental health in the long run (Mahjoob et al., 2014; Kiyani et al., 2011). In Surah Al-Araf (7:204), God promises blessing to those who listen to the Quran. In fact, when someone is reading the Quran, it is rather mandatory for others to contemplate in silence as shown in (Figure 2.4).

Figure 2.4: Promise of blessing in the quran

﴿Hence, when the Qur'an is voiced, hearken unto it, and Listen in silence, so that you might be graced with [God's] mercy﴾.

(Al-Quran. Surat Al-A'raf 7:204)

Serenity is achieved in this context because Quran prompts the believers to remain calm in trying circumstances, even when the situation is entirely against them. To note, they should not fall into despair in the face of predicament, nor be arrogant in the event of abundance, such as great wealth and prosperity. This is explained in Surah Hadid as shown in Figure 2.5.

Figure 2.5: Serenity in the quran

﴿No misfortune can happen on earth or in your souls but is recorded in a decree before We bring it into existence: That is truly easy for Allah﴾.
 (Al-Quran, Surat Al-Hadid 57:22)

﴿In order that ye may not despair over matters that pass you by, nor exult over favours bestowed upon you. For Allah loveth not any Vainglorious boaster.﴾
 (Al-Quran, Surat Al-Hadid 57:23)

Finally, listening to the Quran can also enhance memory. Research on memory (Hojjati et al., 2014) finds that spending approximately 15 minutes a day to listen to the Quran can help students to fortify their memory. As such, it is commendable for them to make this practice as part of their routine, perhaps by dedicating the early hour of the day specifically for the sake of this ritual.

To recap the merits, the Quran is one of the ultimate guides to mankind, apart from the hadith. The entire book contains a series of life lessons that can provide a holistic enhancement to the wellbeing of the individual. Reciting the verses sincerely on a continuous basis would internalize the lessons into the hearts of men. In effect, it would inspire them to act more honorably as a whole.

Shifting the focus on the connection of Quran and children, it is wise to accentuate the fact that surah Al-Fatihah must be read within solat to make it acceptable. This suggests that children are taught some of the important verses in the Quran (Arfat, 2013) as early as four years old. In reality, the urgency is quite warranted, given that solat is commanded at age seven and compulsory at age ten, as shown in the hadith as shown in Figure 2.6.

Figure 2.6: Hadith As-Saburah. Necessity of solat for children

The Prophet (peace be upon him) said:

“Command a boy to pray when he reaches the age of seven years. When he becomes ten years old, then beat him for prayer.”

(Hadith. Sunan Abu Dawood. Kitab Alsalat. Chapter 2: Narrated by As-Saburah: # 494):

The act of memorizing the Quran can be a challenging task for children. They tend to forget what is learned (Price & Phenix, 2015). Even when they do remember, the retrieval is not exact. For instance, certain parts of the verses are not cited as they should be. Some portion of the verse could be interchanged with another that disrupts the coherence of recitation.

The predicament faced by children in memorizing the Quran is not entirely surprising. Perhaps this is due to the fact that they are easily distracted (Wetzel & Schröger, 2007) by their surrounding and it is well known that transferring the Quran into memory requires considerable focus and persistence. Thus, it is usually testing for a child to remain steady in his attempt for memorization.

To foster discipline in the memorization of Quran among children, conservative educators tend to enforce strict punishment such as caning (Hecker et al., 2014). For example, children who commit any mistakes in reciting the Quran from memory are instantly penalized by hitting them. Although some may argue that this approach brings result, it is not really recommended in Islam as shown in Figure 2.7.

Figure 2.7: Fierceness vs. Compassion in Islam

It was by the mercy of Allah that thou wast lenient with them (O Muhammad), **for if thou hadst been stern and fierce of heart they would have dispersed from round about thee.** So pardon them and ask forgiveness for them and consult with them upon the conduct of affairs. And when thou art resolved, then put thy trust in Allah. Lo! Allah loveth those who put their trust (in Him)
(Al-Quran, Surat Al-Imran 3:159)

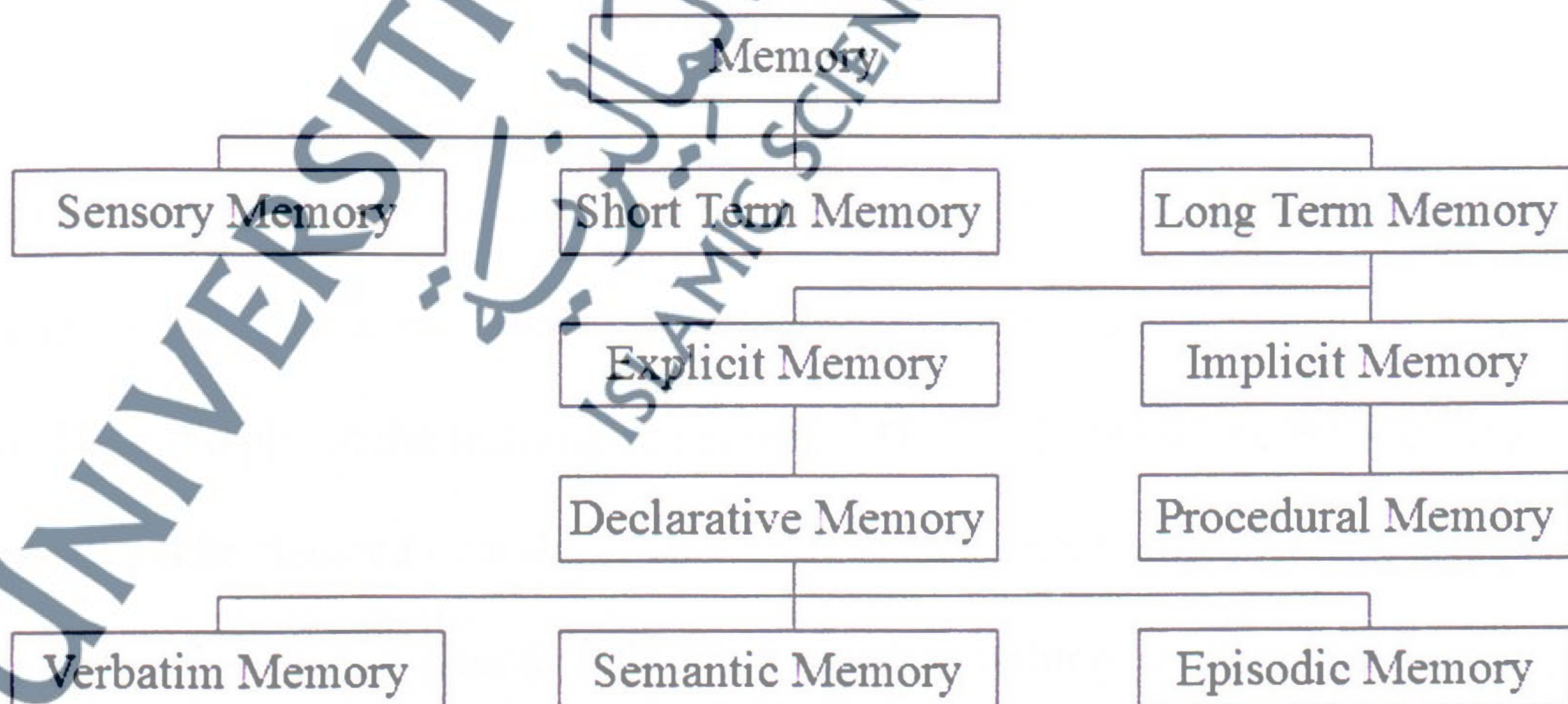
Unpleasantness may deter children from appreciating the true beauty of the Quran. As explained in the verse above, being extremely harsh would repeal the students further away. Not just that, they may suffer constant fear (National Scientific Council on the Developing Child, 2010) during the process of memorization, which is detrimental to the memory.

Knowing the issues that arise with the memorization of Quran among children, more progressive educators are proposing new approaches such as e-learning and m-learning (Mohammadi, 2015) that can be both effective and enjoyable to children. It is argued that this would promote a more frequent connection between children and Quran as they grow into adulthood.

2.3 Memory Classification

Memory is practically the human capacity to recall what is stored in mind. It is mainly classified into sensory memory, short term memory and long term memory (Figure 2.7). Sensory memory (Vandenbroucke et al., 2014) is concerned with the memory gained from senses such as sight and sound. Short term memory (Dungan & Vogel, 2015) is used when the mind is engaged in active thoughts, which is often related to working memory (Bayliss et al., 2015). Long term memory (Kizilirmak et al., 2014) stores information through an extended period of time in terms of two categories, either explicit or implicit. Explicit memory (Alipour et al., 2012) refers to the memory that people are conscious about as opposed to the ones that they are not, such as the procedural memory (Lum et al., 2012). Explicit memory can be further refined into declarative memory (Lum et al., 2015), which contains verbatim (Schönflug, 2008), semantic (Price et al., 2015) and episodic memory (Pan et al., 2015). Thus, the combination of all these information provides us with the pig picture as in Figure 2.8.

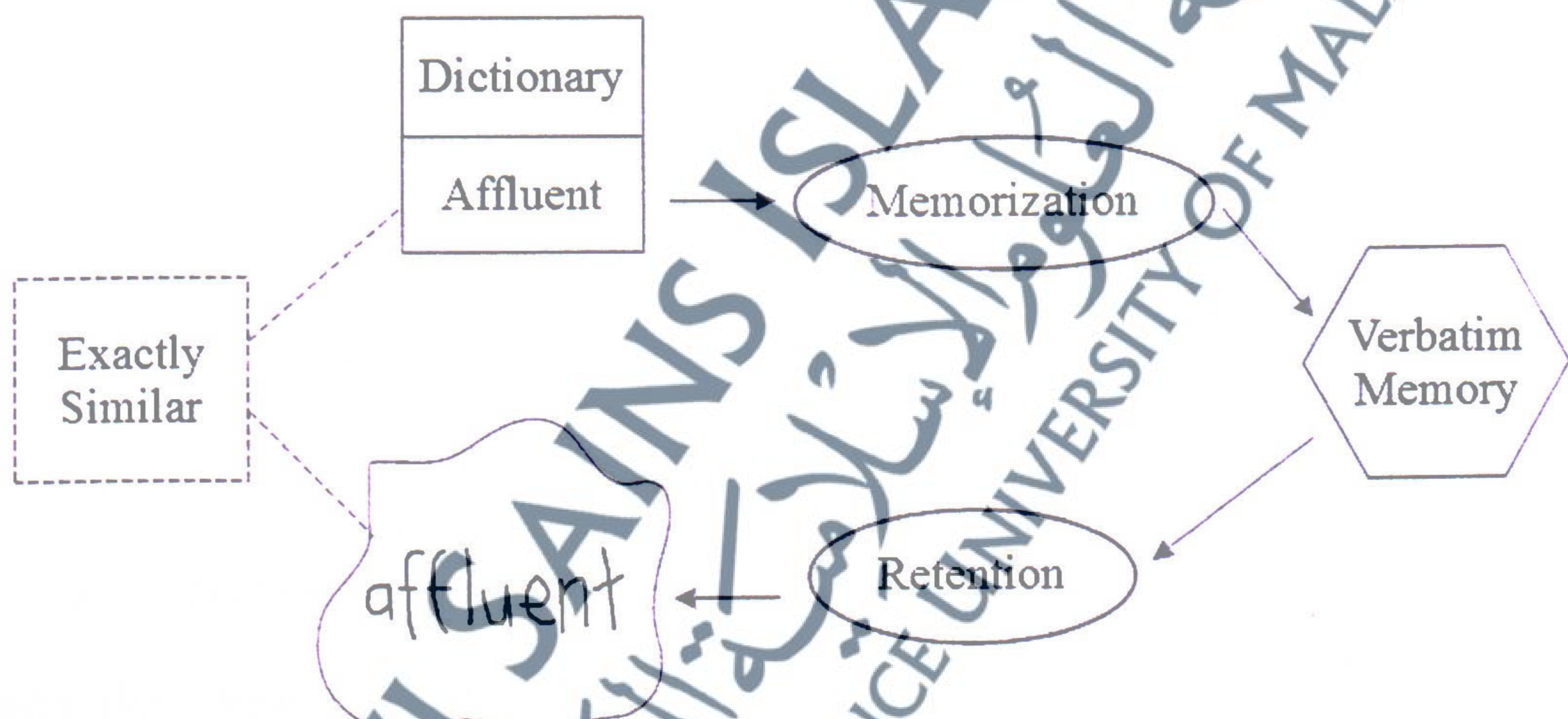
Figure 2.8: Classification of memory



2.3.1 Verbatim Memory

Verbatim memory (Margulis, 2014; Mih, 2009) is characterized as the capacity to remember something exactly as it is without any change or distortion. This implies that the information is retrieved as it is encoded. To get a grasp of the notion with better clarity, consider the case of a child learning a new word. After memorizing the term “esoteric” from the dictionary, the child closes it and reproduces the word accurately on paper (Figure 2.9) via retention.

Figure 2.9: Verbatim memory



As illustrated in figure 2.9, verbatim memory is crucial in the case of learning, where the precision of an artifact must be maintained. This can occur in many instances in life. For example, in the learning of language (Hazrat, 2014) where the meaning of a word could be changed by a single character. Imagine what would happen if the child attempts to use it in a note to a friend. Instead of writing “affluent” he mistakenly writes “effluent”. The meaning is corrupted from “rich” to “waste”.

In the academic arena, verbatim memory plays a vital role as well. Certain fields such as literature require the student to know the literary source in its original form. To quote an example, consider a series of text taken from the “the prophet” by Kahlil Gibran (Ludescher, 2006; Al-Khazraji et al., 2013). In appreciating the prose, students are expected to know it by heart, word for word. As such, there is no other way of learning it besides committing the text by its entirety to memory.

“Your joy is your sorrow unmasked.

And the selfsame well from which your laughter rises was oftentimes

Filled with your tears.

And how else can it be?

The deeper that sorrow carves into your being, the more joy you can contain”

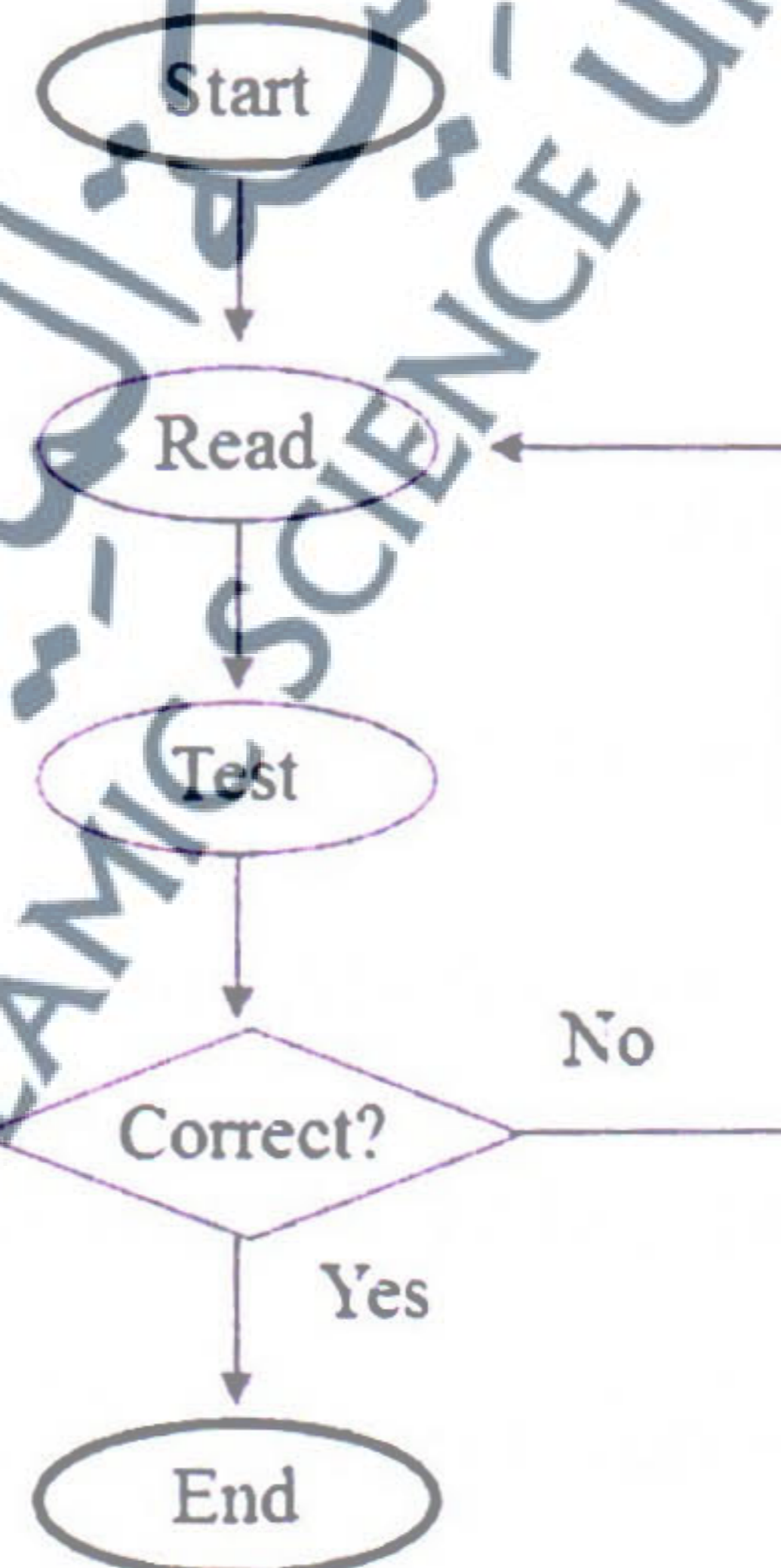
The role of verbatim memory extends beyond literature and linguistics. For instance, in the study of statistics, it is consequential to know the accurate formula to use in a particular situation. A marginal mistake in asserting the correct equation would render the entire calculation useless. Similar precision is expected for sciences (Rawson & Kintsch, 2005) such as physics and chemistry.

Given the importance of verbatim memory, it is therefore essential to understand its foundational mechanism and dynamics, particularly in how it is formed (Cheng & Rugg, 2010) and can be retrieved in a timely fashion. This way, it would be feasible to conduct betterment in a more realistic manner, especially when the act of memorization necessitates an extensive dedication of time.

Repetition is one of the most popular techniques of realizing verbatim memory. Perhaps this can be attributed to its simplistic strategy that does not require any form of higher thinking to implement. There is a minimal need for metacognition (Logan et al., 2012) or complex decision making. It also seems natural given that the adage “practice makes perfect” (Allen, 2007) is rather conventional to most communities of the world.

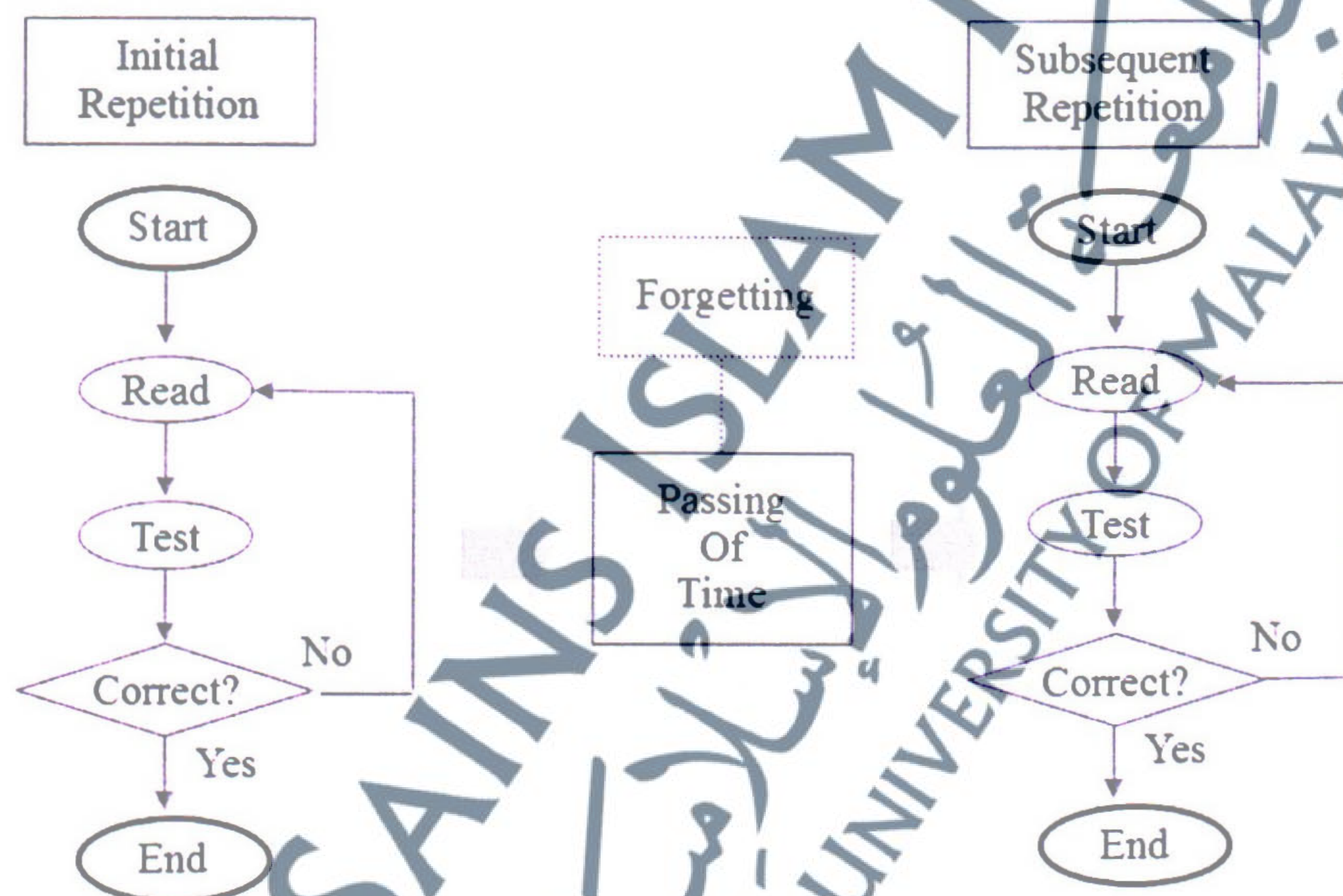
To employ repetition, the item to be memorized is repeated again and again (Kang, S. H. 2016) until it is committed to memory (Figure 2.10). The individual will then perform a kind of personal test (Roediger III & Karpicke, 2006) to ascertain whether what is remembered is precisely as intended. If the memory fails, the entire repertoire is done again. Invariably, the cycle is limited to temporal confinement whereby the repetition is ceased when there is no more time left for the exercise to continue.

Figure 2.10: Repetition in verbatim memory



As time passes, memory normally experiences decay. This would cause the items memorized to be forgotten. In order to combat this problem, repetition can be done at different time intervals to ensure a more lasting impression. This is a technique known as spaced repetition (Wu, 2014; Matsuoka & Hirsh, 2010) of which the item to be remembered is reviewed at different times. As shown in (Figure 2.11), repetition is performed again after the initial one.

Figure 2.11: Spaced repetition



Theoretically speaking, when the items are repeated often enough, they would remain in memory or more specifically, the long term memory (Dark & Loftus, 1976). This phenomenon is prevalent in remembering information that is important to oneself (Conway, 2005). People usually remember their birthday because the information is retrieved repeatedly at different times in life. For instance, when filling a form or conversing with friends, they recall the date again and again.

To illustrate the notion of spaced repetition, consider the situation of having to memorize a list of many items. Once the items are memorized by verbatim, it will deteriorate through time. To maintain memory, assume that they are refreshed on a certain schedule (Pavlik & Anderson, 2008) of different time intervals that are subsequently made longer and longer with each passing review (Table 2.0).

Observe that the first review is done immediately (Burgess & Hitch, 2006) after the items are memorized. Then, the second review is performed at the end of the day and the third on the next day. The fourth review occurs at the end of the week while the fifth one at the end of the month. Here, it is quite clear that the interval is purposely designed to be incremental for the sake of improving long term retention.

Table 2.1: Schedule for spaced repetition

Review	Schedule
1	Immediately
2	End of the day
3	Next day
4	End of the week
5	End of the month
6	Three months later

Spaced repetition calls for a significant level of self-discipline (Pearman & Storandt, 2005) to work. It requires the individual to rehearse the regiment consistently through time. Failing to do so can jeopardize the integrity of verbatim memory. For instance, if rehearsal is not done before forgetting, relearning is needed. Managing this can be a daunting task as the number of items grows.

The most apparent drawback of employing repetition for verbatim memory is the accumulative temporal demand. In other words, repetition can take a lot of time. As more items are added, the longer it would take to memorize new ones. This is due to the fact that the strain of memorizing becomes greater with more items (Klingberg, 2010), inadvertently causing learning stress.

With the emergence of excessive stress (Lee & Goto, 2015); it becomes more difficult for the learner to engage in memorization. Most would then resort to the allocation of longer duration for remembering. However, investing more effort at this juncture can be counterproductive. It perpetuates a self-defeating cycle that can portray memorization as something almost insurmountable.

Another issue in verbatim memory is the risk of decay (Lago, 2014) or forgetting. Items memorized could be forgotten as soon as the end of engagement. This is caused by the fragile construct of verbatim memory as suggested by the fuzzy trace theory. As such, it requires significant effort to sustain the memorized impression through time. Memory must be consistently refreshed to facilitate retainment.

Finally, repetition does not really provide motivation for learning (Palmer, 2005). Its monotonous trait can be rather prosaic. More often than not, it is quite easy for a person to fall into boredom after reviewing the same item repeatedly without end. This can eventually lead to the loss of focus (Radomsky et al., 2014) whereby the learner is no longer driven to memorize the subject at hand.

2.3.2 Semantic Memory

Unlike verbatim memory that faithfully captures an idea in its original form; semantic memory (Brockmole & Vo, 2010) is more concerned with the meaning. It is therefore not as precise as verbatim memory. In fact, semantic memory has a tendency for abstracting and paraphrasing (Hirvela & Du, 2013) the idea into its essence. Here, the structure is changed without sacrificing its core meaning. As a consequence, only the gist remains intact.

To demonstrate the elements that constitute semantic memory, it is quite useful to ponder upon the situation of reading a storybook (Figure 2.12). Children often remember the general idea or theme of the story (Currie & Cain, 2015) but not the exact text. Thus, when questioned what the knight had said to the princess after being separated from her through a protracted period, semantic memory would normally retrieve the longing displayed, and not the poetic expression.

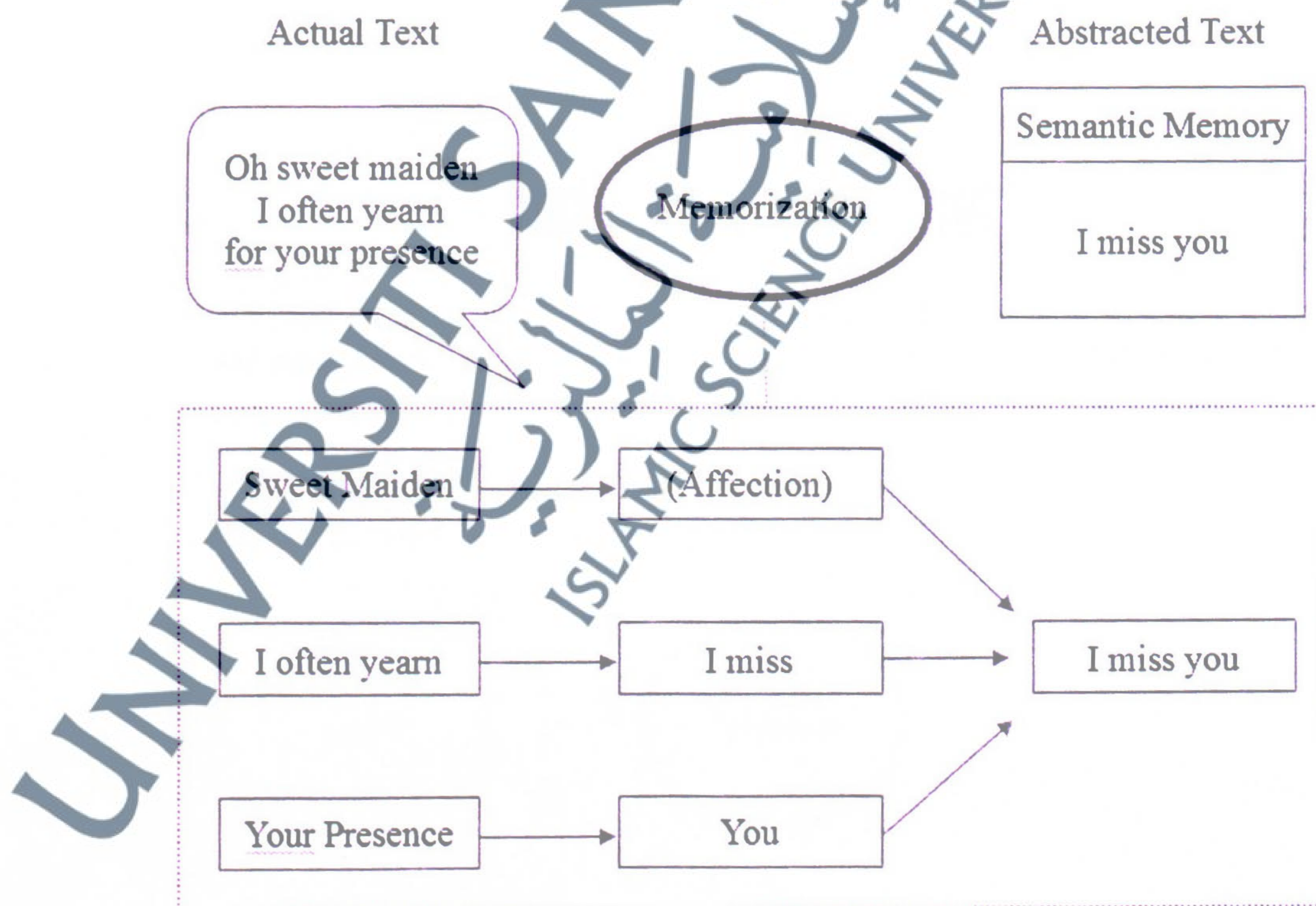
Figure 2.12: Example of semantic memory



Understanding is vital in the construction of semantic memory (Haarmann et al., 2003; Lesch, 2003). Comprehension must precede memorization for it to occur effectively. If the sense escapes the mind, it is almost impossible to enable this type of memory. As such, when memorization is imposed upon the individual in the absence of meaningful appreciation, it is usually a form of verbatim memory.

Comprehension often emerges by finding the connection between ideas (Borghini & Riggio, 2009; Seidenberg, 2007). As the meaning of one idea is related to the other, the entire conceptual manifestation would gain clarity. Contemplating again on the previous example (Figure 2.13), it is quite possible to analyze the plausible rationale behind the linguistic simplification portrayed by semantic memory.

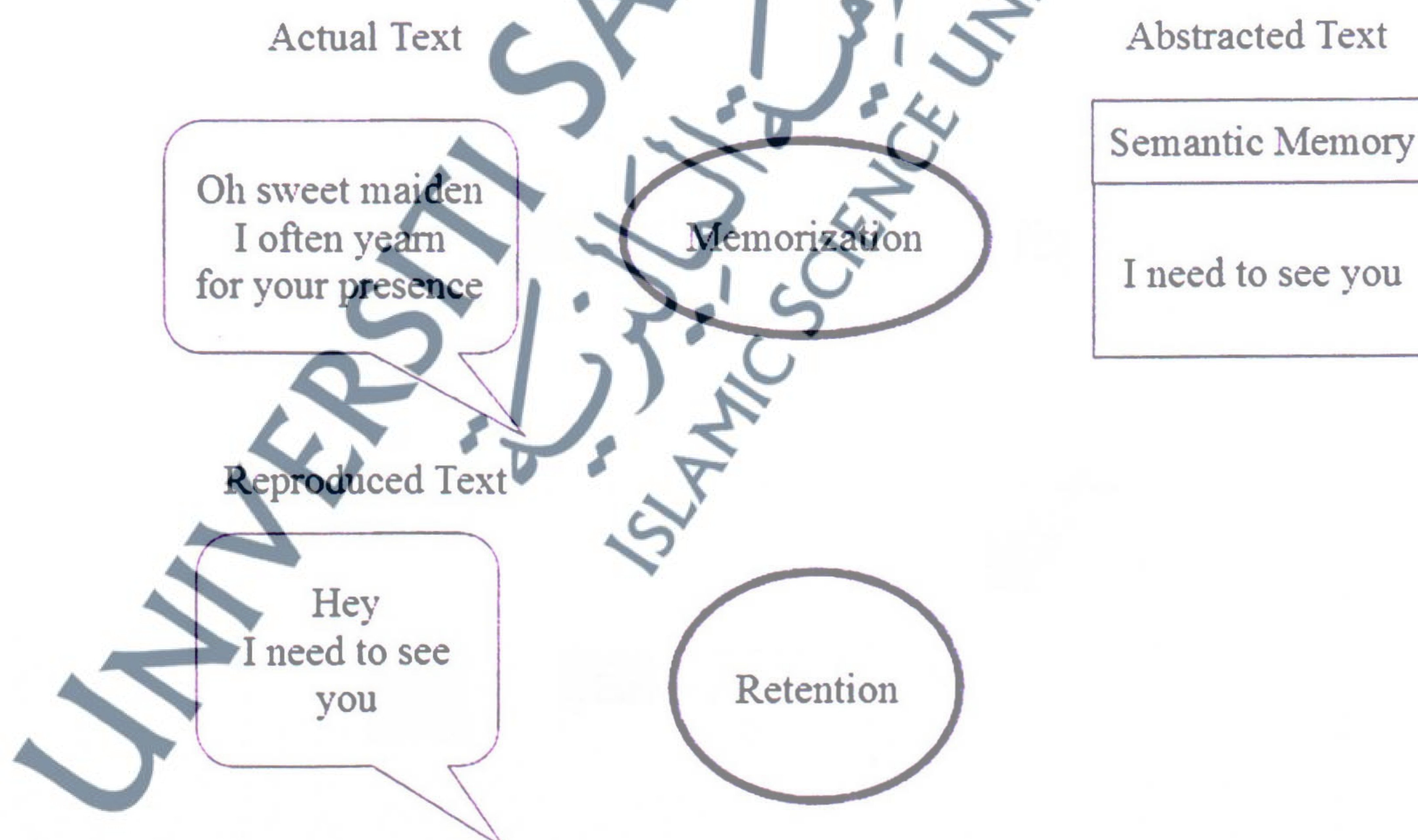
Figure 2.13: Possible rationale for semantic memory



The phrase “oh sweet maiden” is basically a gambit expression (Slobin, 2003) that shows the affection of the knight. In this sense, it can be omitted without losing the fundamental meaning of the text. Looking at the next phrase “I often yearn”, it is not hard to paraphrase it to “I miss”. Finally, “your presence” is a poetic way of saying “you”. Having all these understanding allows the abstracted text to come into existence as a semantic memory.

Since semantic memory exhibits an affinity of employing abstraction, there is always a danger of distortion (Saunders et al., 2012; Schacter et al., 2011). It happens when the meaning of an idea does not reflect what it actually is. For instance, it is quite easy to misinterpret the message conveyed by the knight as something else (Figure 2.14). In effect, a different meaning (“Hey, I need to see you”) that does not equate to the original meaning of the text is implied.

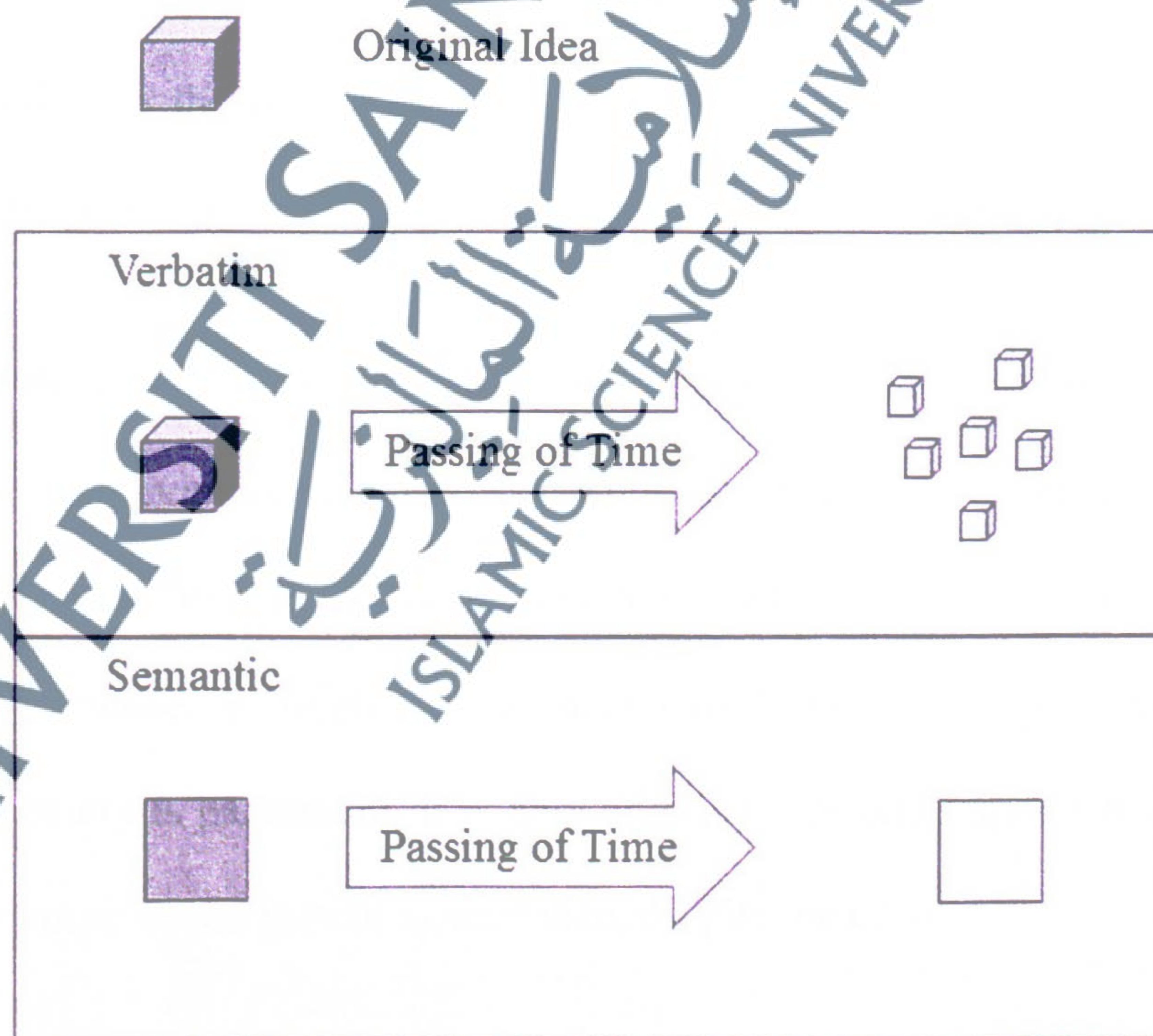
Figure 2.14: Distortion in semantic memory



Although semantic memory lacks accuracy when compared to verbatim memory, it is more stable through time (Reyna, 2012; Rogers et al., 2004). Stable here means in the sense that it does not experience a swift decay (Berman et al., 2009) and seems to be more resistant towards interference. This implies that a person tends to remember the gist of a concept much longer once understanding is obtained. It is true even when the concept is not reviewed often.

In Figure 2.15, witness the original idea that is metaphorically represented as a 3 dimensional box. Clearly, verbatim memory stores the original idea as it is. However, the idea collapses with the passing of time. On the other hand, despite the fact that semantic memory only retains a 2 dimensional impression of the artifact, it can withstand the test of time better.

Figure 2.15: Stability of semantic memory and verbatim memory



The stability of semantic memory (Yee et al., 2013) can be witnessed in the manner of children relishing a fairytale. Most stories often provide a lesson to be learned. Supposed that one entails a battle between light and darkness, such as sleeping beauty (DeMarcus,1999), and the theme states that even though evil could span a significant amount of time, in the end, good would always prevail.

The lesson within the story is a form of semantic. Note that once the lesson is stored in semantic memory, it tends to remain there through time. A child who understands and memorizes the gist of a fairytale may not review it often. However, even years later, the child may still remember how the prince had fought against the forces of evil to free the princess.

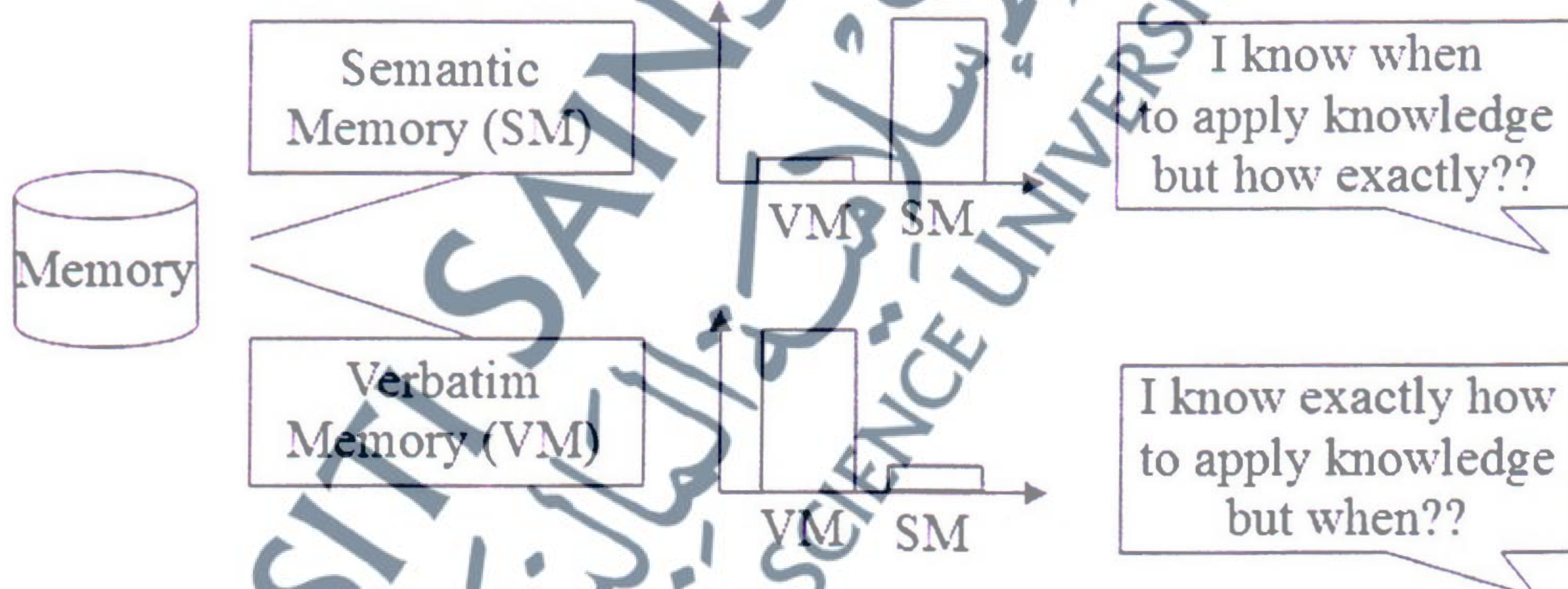
In addition to being steadfast against temporal progression, semantic memory is also more flexible in application (Anand et al., 2012). It allows the individual to retrieve the relevant memory in a diverse set of cases that goes beyond acquisition. For instance, although the lesson of good vs. evil is gained from the fairy tale, the children can see its importance in other contexts of real life situation.

To explain the relevance of flexibility more clearly, consider the situation faced by the child in the previous example. He may not see the monstrous antagonists such as witches or dragons in real life, but the encounter with evil is far from a fantasy. At school, for instance, he might be victimized by bullies. Here, the application of semantic memory is paramount. It is now crucial to quickly remember (Cook et al., 2014) how virtue would prevail against vice, despite the odds.

Semantic and verbatim memory must be coordinated (Griffiths & Steyvers, 2007) for learning to happen effectively. The former is needed to sustain memory and widens its application. However, too much semantic memory without verbatim memory can be disastrous (Figure 2.16). The individual knows ideas generally but may not be able to use it in an actual procedure that demands an exact execution.

A similar argument is true with verbatim memory. It is pivotal in dealing with cases that require precision (Willoughby et al., 2014). For example, a student cannot perform certain reasoning without maintaining the exact formula in memory (Kelley & Sahakyan, 2003). Nevertheless, too much verbatim memory is not advisable, since it might prevent the potential application of knowledge.

Figure 2.16: Imbalance Semantic Memory (SM) and Verbatim Memory (VM)



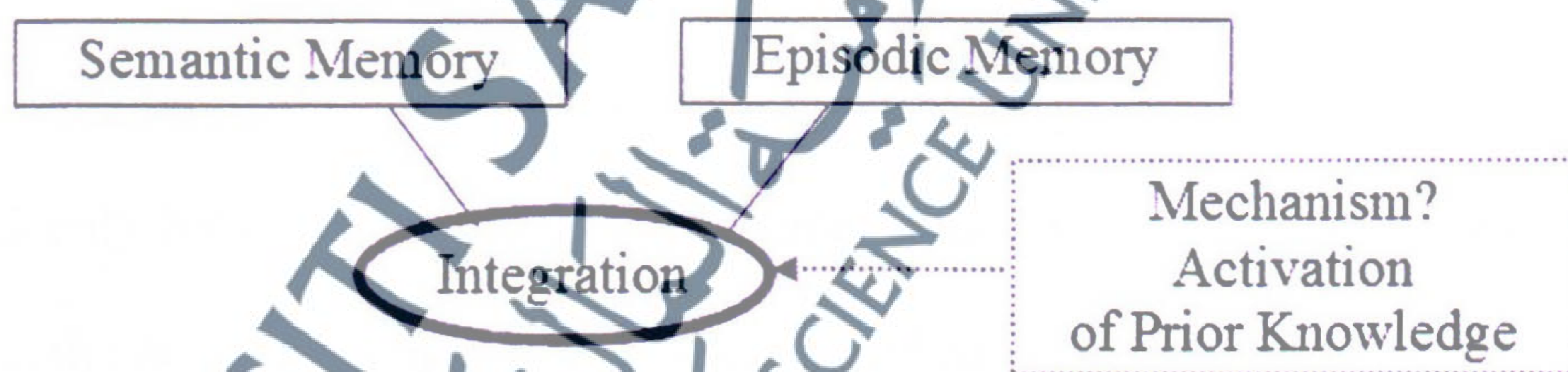
Knowing the right balance or ratio between both types of memory is therefore a necessity. With integration, it is possible for the learner to transfer knowledge more fluidly (semantic memory) and still be precise in the process of application (verbatim memory). Not just that, remembering the exact knowledge (verbatim memory) through a longer period of time (semantic memory) is now viable.

2.3.3 Memory Integration

As suggested in the previous section with regard to the importance of integrating verbatim and semantic memory, the feasibility of this attempt is highly probable. This is evident in a research on semantic and episodic memory (Hemmer, P. & Steyvers, 2009a) of which the cooperation between the two is shown to be rather beneficial (Hemmer & Persaud, 2014).

In cases where knowledge is fortified but the representation from memory is fragile, reliance is given more towards semantic memory. On the other hand, for situations where knowledge is limited but experience is abundant, then episodic memory is consulted for recall. The interchanging dominance on the basis of resources makes memory retrieval quite versatile.

Figure 2.17: Integration of Semantic and Episodic Memory

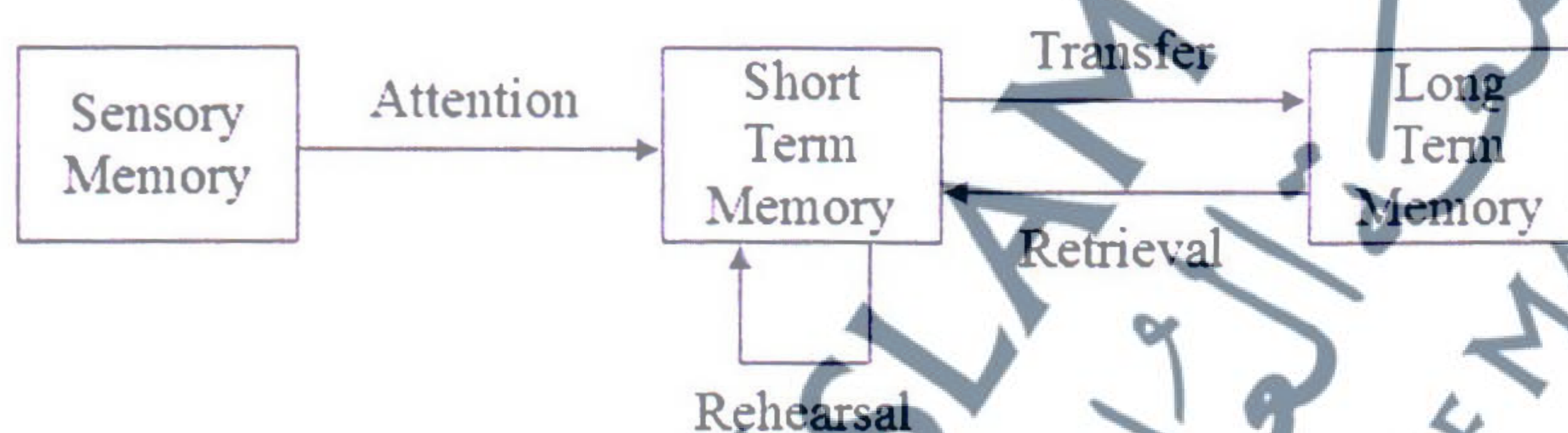


The key to the integration of memory is designing a series of actions that can contribute to the development of dual or more memory types simultaneously. For instance (Figure 2.17), in the integration of semantic and episodic memory, the activation of prior knowledge is commendable (Hemmer, P. & Steyvers, 2009b). To explore the ideas further, the models of memory are inspected in the next section.

2.3.4 Multi-store Memory Model

One of the earliest models on memory is the multi-store memory model (Upadhyay, 2011; Atkinson & Shiffrin, 1968) which has undeniably become the referral point of later models. The model (Figure 2.18) involves three main components – sensory memory, short term memory and long term memory. Here, each component differs from one another in terms of duration and capacity.

Figure 2.18: Multi-Store memory model (Atkinson & Shiffrin, 1968)



Information gathered from sensations such as verbal and visual stimulus is stored in the sensory memory (Rimmele et al., 2015). In this respect, the capacity is considerably large to cater for the various inputs from the surrounding. However, it is retained only for a very short period of time; approximately a few seconds. Due to this fact, the duration of this memory can be said to be naturally fleeting.

To illustrate the idea, when walking through a park, a variety of stimulus is present. This includes the sight of trees, the sound of birds and the feel of the passing breeze. It is said that these stimulus are captured by sensory memory. Still, given the small duration of storage, they are easily forgotten, which explains why a person usually fails to remember what occurs around him.

The contents of sensory memory can be transferred to the short term memory through attention (Lepine et al, 2005). This implies that although a multitude of information is captured by sensory memory, none of them truly registers until attention is channeled towards it. Thus, the sound of birds is not contained in short term memory until a conscious effort is made to realize it.

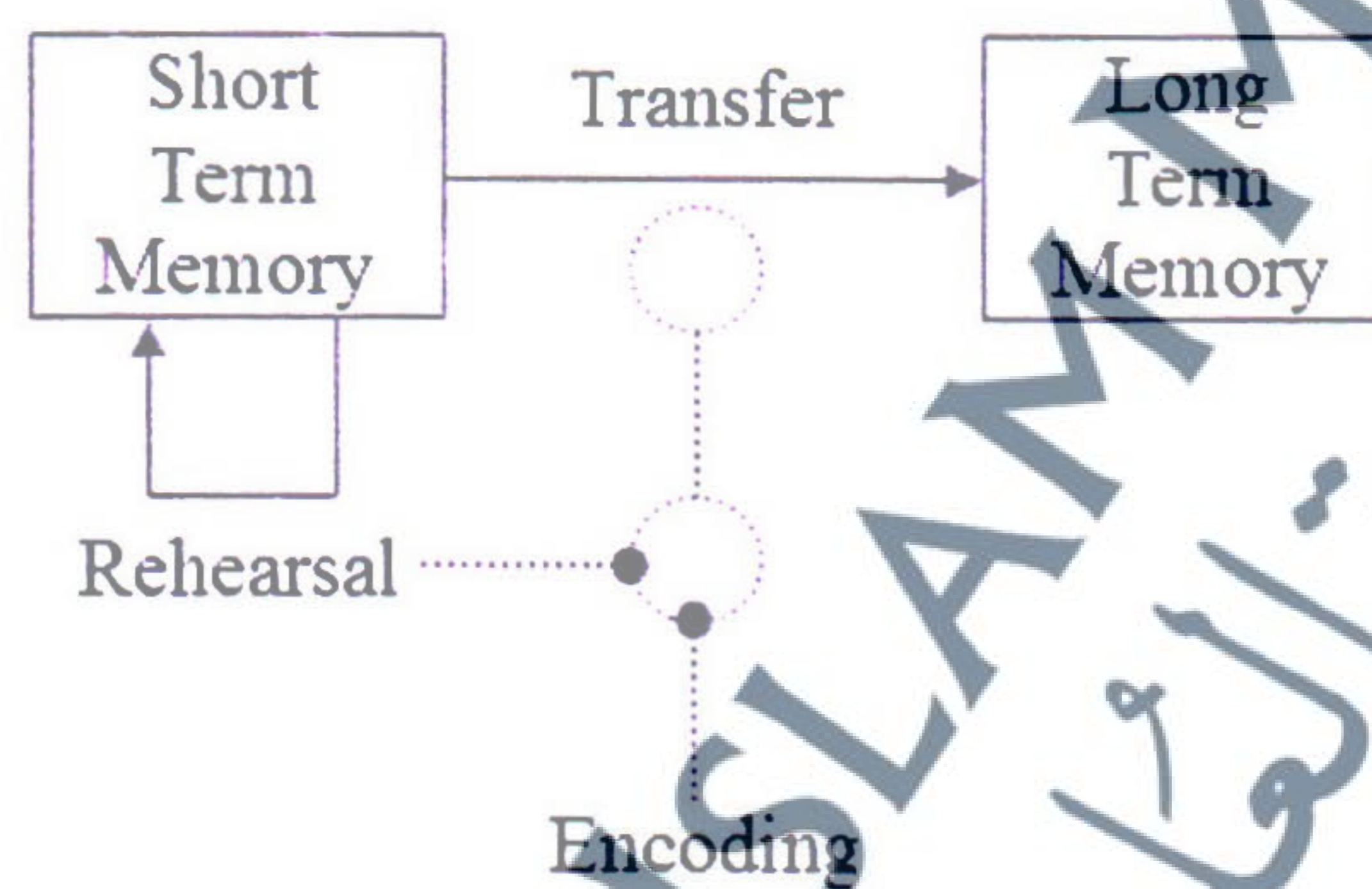
Comparatively speaking, the duration of short term memory (Driot-Volet et al., 2007) is significantly longer than sensory memory. It can last between 10 seconds to half a minute, depending on whether the process of rehearsal is carried out or not. Now, suppose the individual listens to the birds and notices a certain distinctive sound, he may need to hum the tune to retain it.

The capacity of short term memory is limited to approximately seven items (Lavanex et al., 2015). It would be quite difficult for the mind to handle items beyond this number. As such, when there are more items than what the capacity can manage, some might be accidentally forgotten. Thus, the person would possibly suffer forgetting when he concurrently attempts to remember the sound of the birds as well as the group of people talking around him.

Finally, the model defines long term memory (Hitch et al., 2009) as the longest type of storage. The duration can span over an extended duration of time, spanning from a few days to a lifetime. Capacity wise, it is theoretically implied to have an unlimited ability to retain information. A person can therefore store an endless stream of memory that concerns the walk in the park if he so wishes it.

Rehearsal and encoding (Bauer et al., 2012; Fusi, 2001) are crucial in transferring the content of short term memory into long term memory (Figure 2.19). The former requires a deliberate effort of repeating the information to be remembered through time. On the other hand, the latter refers to the manner that information is processed. Greater processing ensures a better long term memory.

Figure 2.19: Rehearsal and Encoding in Transfer



To clarify the concept of encoding better, think upon the act of memorizing the names and faces of people that one have met at a party. The person can indulge in rehearsal by quietly repeating the information. Alternatively, it is more effective to improve the encoding process, perhaps by linking the new person to someone he knows in the past (Bergman et al., 2012).

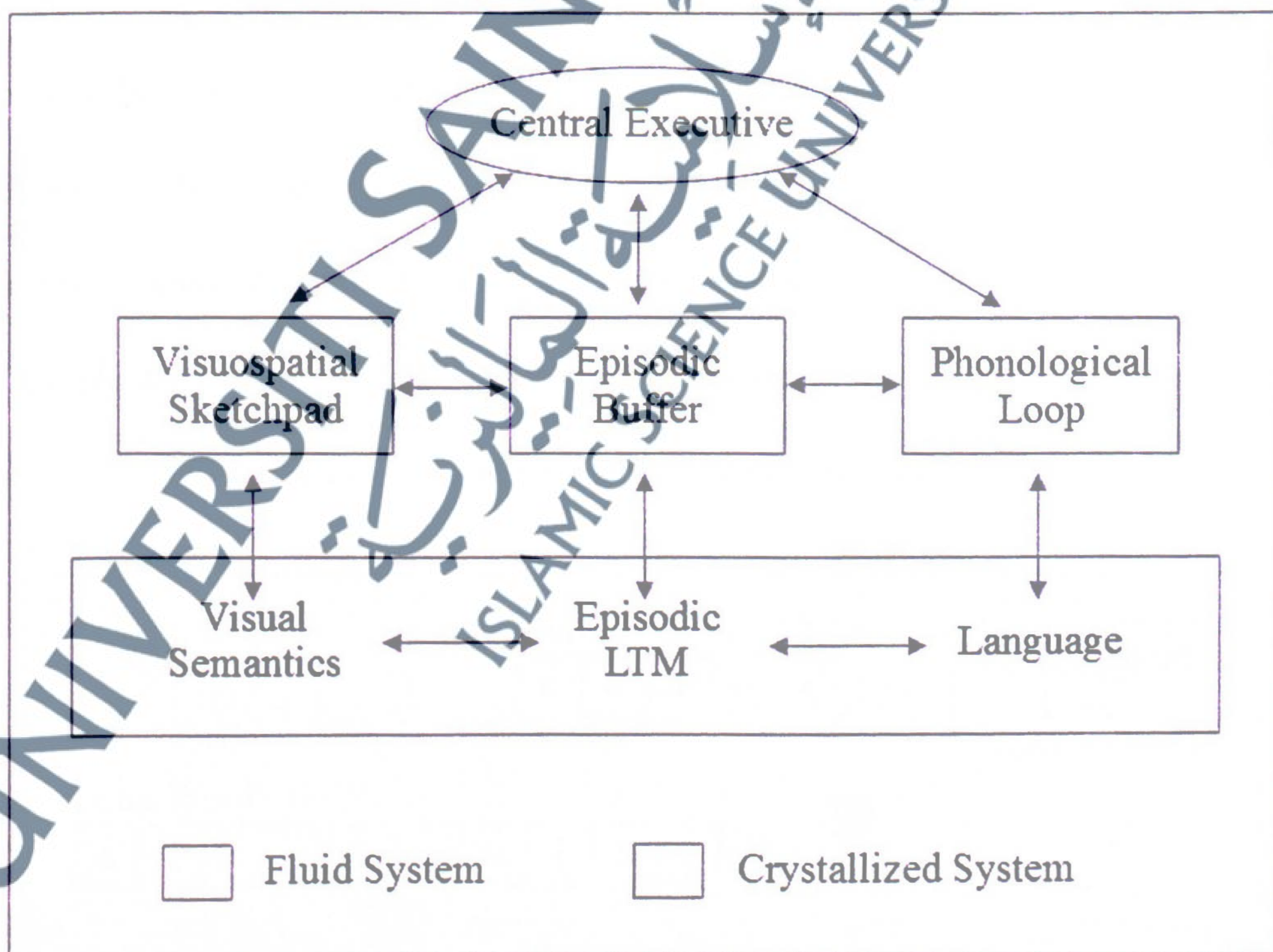
The contribution of a multi store memory model in this research cannot be understated. It serves an impetus in analyzing the intricacy of memory from the perspective of information processing (Lutz & Huitt, 2003). Not only that, the model also offers a lucid separation on the processes that are pertinent in memorization.

This greatly assists the enhancement exercise as a whole.

2.3.5 Working Memory Model

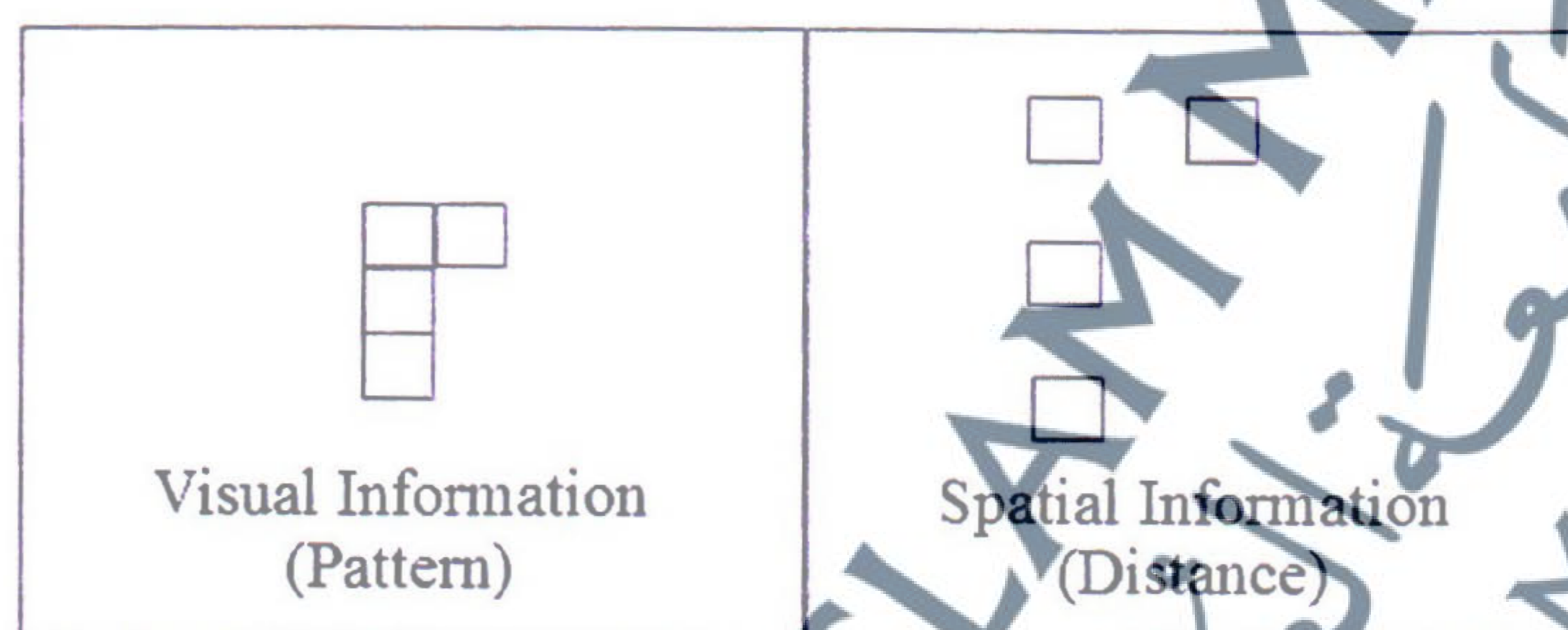
In comparison to the multi-store memory model that is covered in the earlier section, it can be said that the working memory model (Baddeley, 2003) is focused mostly on the detailing of the short term memory. The model asserts fluid and crystallized system as the dividing region of the components. The fluid system refers to fluid intelligence (Tamez, E et al., 2012) or the intellectual capacity to engage in active thought. This particular system contains the central executive, visuospatial sketchpad, episodic buffer and phonological loop. On the other hand, the crystallized system signifies crystallized intelligence (Dang et al., 2012) or the ability to utilize experience, skill and knowledge. It consists of visual semantics, episodic LTM and language. The entire model is depicted in Figure 2.20.

Figure 2.20: Working memory model (Baddeley, 2003)



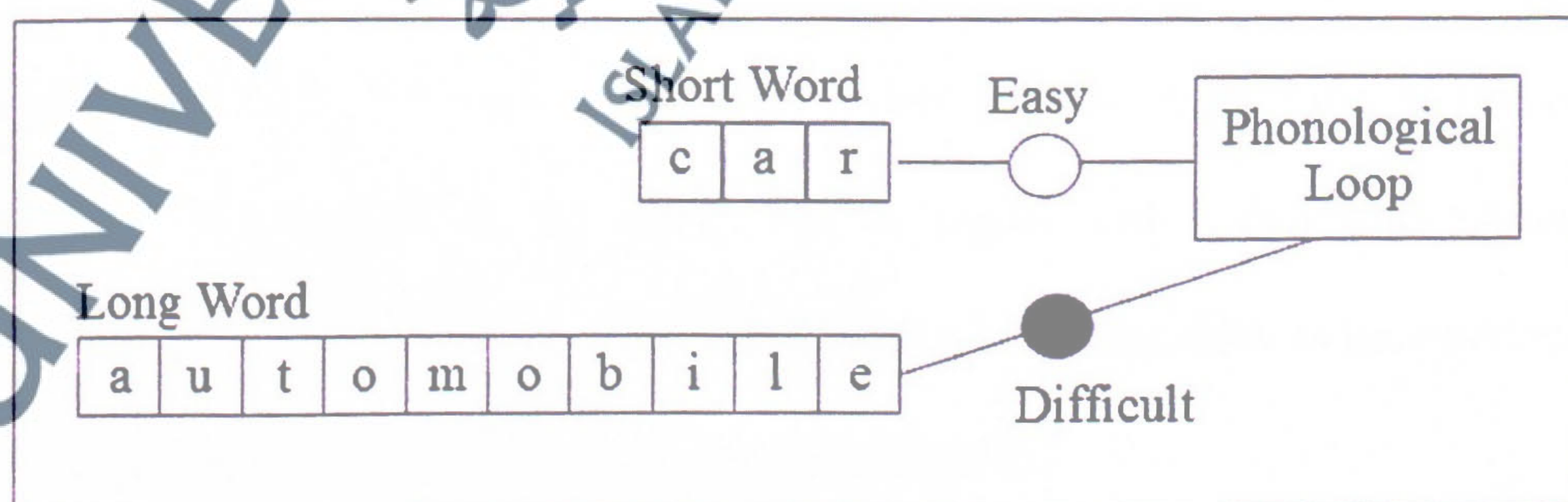
When a person reads a book and indulges in thinking, the visual and spatial information (Chraif et al, 2014) is stored for a brief period in the visuospatial sketchpad. This allows the information to be processed by the mind. Visual information is contained by what a picture is, in terms of pattern whereby spatial information is constituted by the display of distance (Figure 2.21).

Figure 2.21: Visual vs. Spatial information



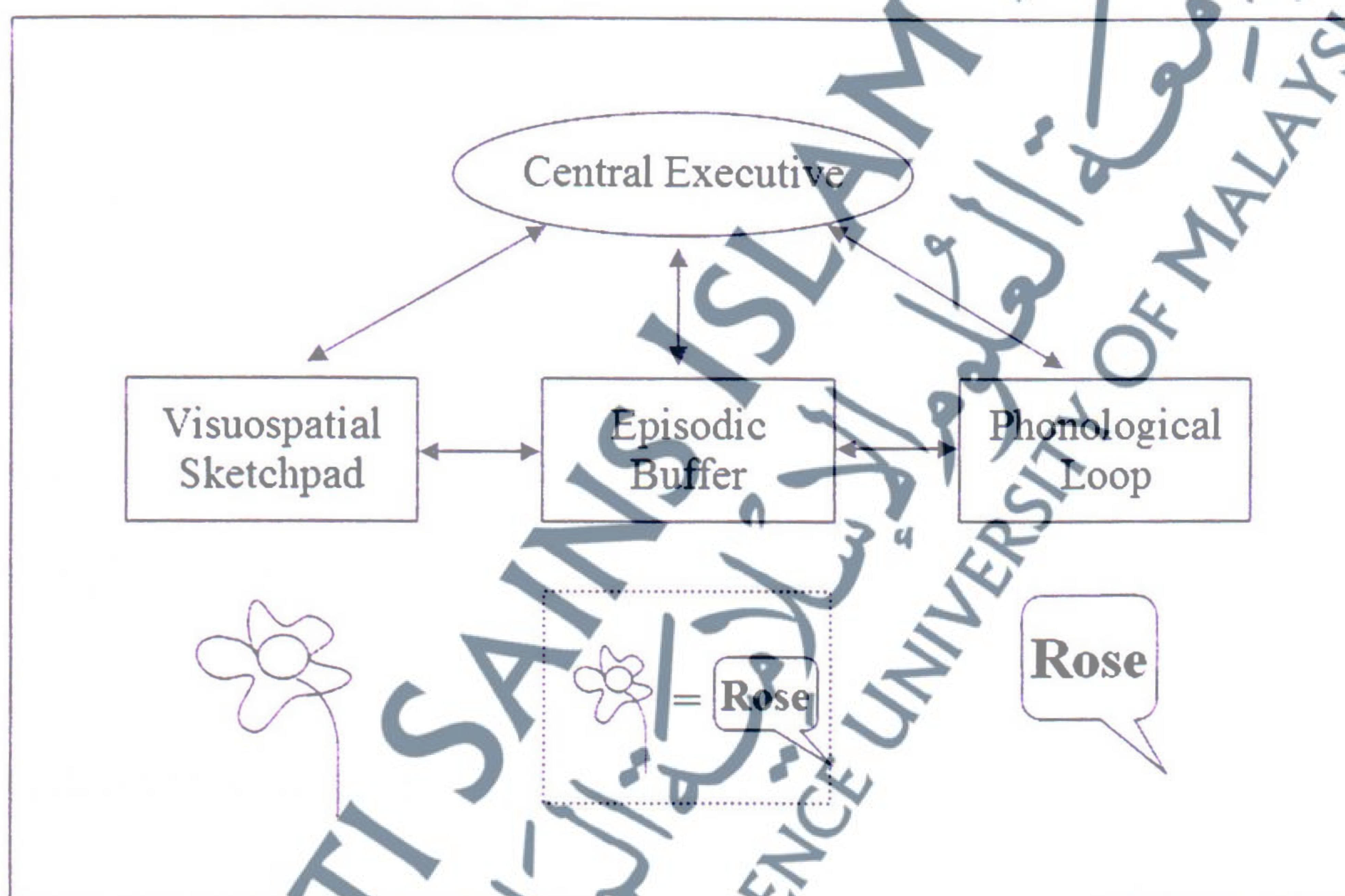
Supposed that the person reads a book and he explicitly vocalizes what is printed on the paper, then the memory traces of the sound from his speech is stored momentarily within the phonological loop before fading away. To retain the information, the sound needs to be rehearsed. Given the factor of time and the decaying of memory, shorter words are easier to remember than longer ones (Figure 2.22), a phenomenon known as the word length effect (Joseph et al., 2009).

Figure 2.22: Short vs. Longer words in remembering



Streams of information from the visuospatial sketchpad and phonological loop are integrated within the episodic buffer (Ghetti & Bunge, 2012; Henry, 2010). It must be pointed out that these streams are not congruent. The episodic buffer therefore enacts a vital responsibility of organizing information from different dimensions to enable sense making. Thus, when someone hears the word 'rose' and sees the flower, the connection between the two would occur at the buffer as shown in Figure 2.23.

Figure 2.23: Episodic buffer and Central executive in memory integration



According to the working memory model, the episodic buffer is controlled by the central executive (Geary et al., 2012) through attention. Thus, only when the individual is aware of a particular sound (rose) and its picture would the two be integrated. There might be an inundation of visual and verbal information that compete for the attention of the individual. The central executive is thus accountable for managing the attention without being overwhelmed.

2.4 Cognitive Theory of Multimedia Learning (CTML)

The central theory for this research is the cognitive theory of multimedia learning (CTML) (Khan & Masood, 2015; Mayer, 2014; Mayer, 2009; Sorden, 2005). It is mostly concerned on how to utilize multimedia elements to enhance the performance of learning. It does not stand alone but could be related to other theories such as the multimodal theory, the schema theory and the cognitive load theory.

Multimodal theory (Zheng, 2008) explains the relationship between senses, activation and memory. A learner may sense a series of stimulus input such as sound and image. In return, a respond can be manifested through motor action and speech. CTML recommends the most commendable synergy of senses and activation.

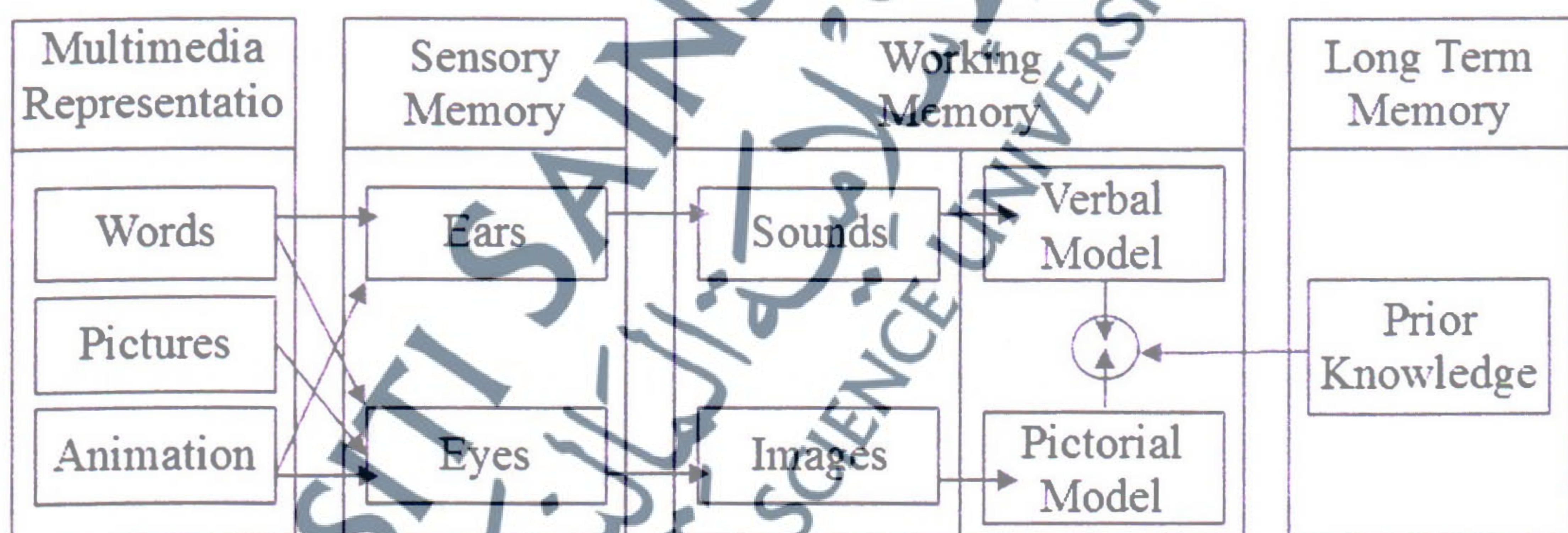
Schema theory (Zhuge & Sun, 2010) is practically concerned with the mental organization of knowledge. Knowledge that is more organized would be easier to access, apply and change. Presently, CTML highlights a set of effects or principles that can be exploited to drive the design of multimedia representation. This in turn would affect the internal organization that resides in the mind.

Cognitive load theory (Shehab & Nussbaum, 2015) postulates the idea of load or difficulty in thinking by suggesting the internal load, external load and germane load. External load is the difficulty that exists due to representational factor, which is connected to CTML in terms of how the design can be done. A better design would allow for lesser load, thus improving the performance in learning.

To gain a better overview of the central theory, the framework is illustrated (Mayer, 2003) in Figure 2.24. It combines the multi-store memory model with the elements within a multimedia representation to explicate their direct and indirect connection. As explained in Figure 2.8 the subsection of memory classification, memory is divided into sensory memory, short term memory (working memory) and long term memory.

Sounds and images are selected by ears and eyes respectively within the sensory memory. Sounds are then organized into the verbal model (Maybery et al., 2002) while images are structured into the pictorial model. These two processes occur inside the working memory concurrently. Both models would then integrate with the prior knowledge from the long term memory.


Figure 2.24: Framework for the cognitive theory of multimedia learning



To concretize the framework, imagine seeing an animation of a bouncing ball, which is accompanied by a catchy song. Sensory memory would be aware of the animation and song. Through attention, it selects certain sounds and images and funnels them into the verbal and pictorial model in the working memory. Understanding happens when the models connect with prior knowledge from the long term memory.

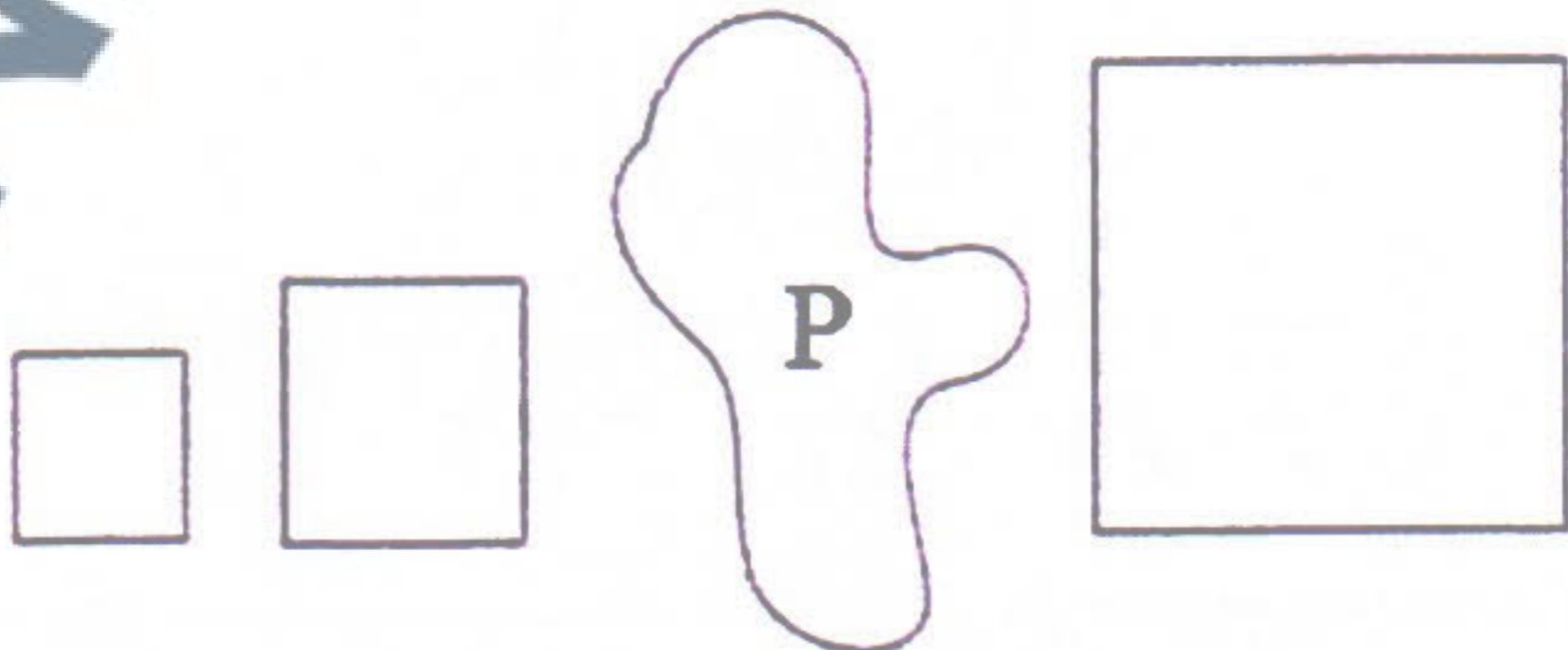
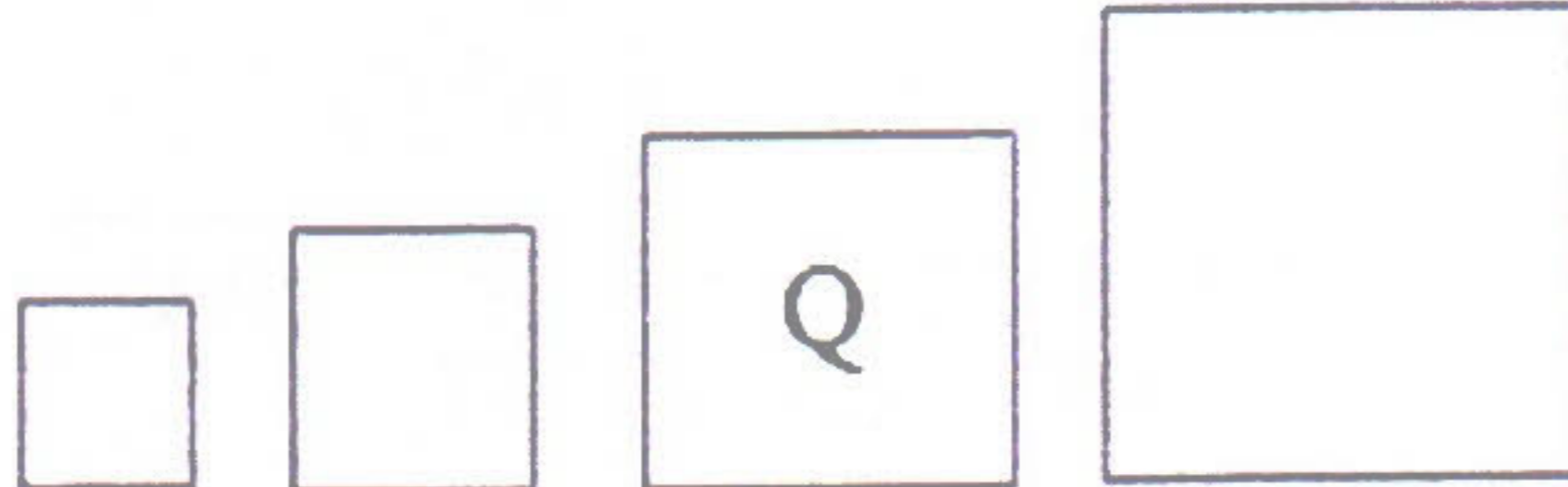
The theory proposes a series of principles or effects. The first is the multimedia principle (Schweppe et al., 2015). It states that learning is more effective when visual and textual elements are combined together as opposed to textual ones only. In the illustration (Figure 2.25), the 1st example contains only text. As such, it does not really promote understanding. The 2nd example is better because it contains picture and text elements which are more effective.

Figure 2.25: Multimedia principle

1	Not Recommended	2	Recommended
	A ball is a Round Object With Certain Attributes such as Color and size		 <p>A diagram of a circle labeled 'Ball'. A line points from the word 'Color' to the circle, and a bracket on the right side of the circle is labeled 'Size'.</p>

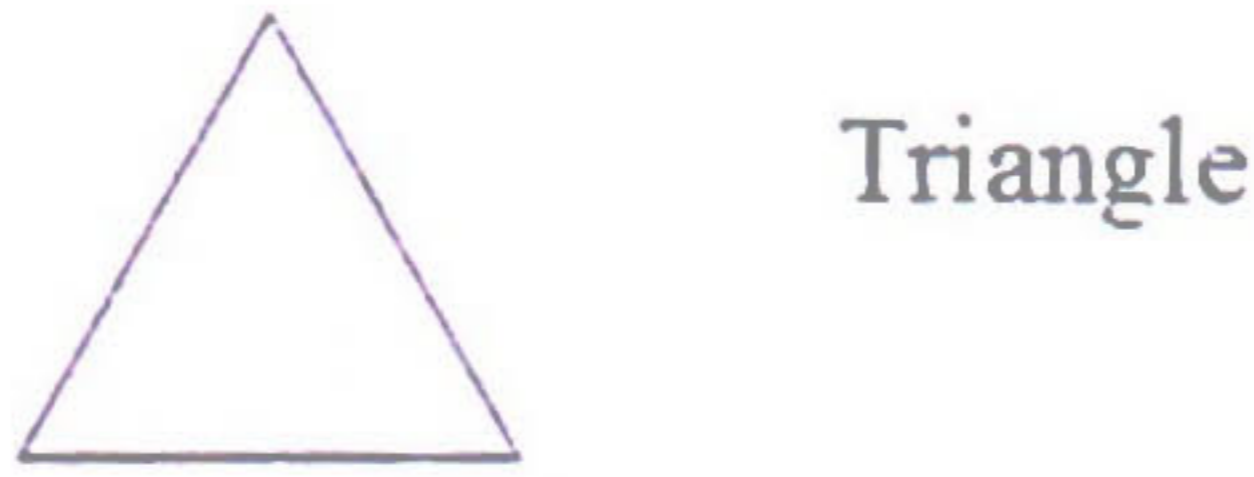
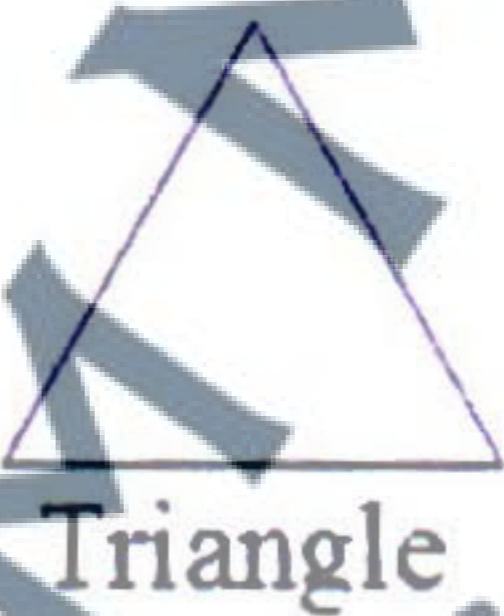
The coherence principle speaks upon the importance of having elements that are consistent with one another and omitting those that are not. To demonstrate (Figure 2.26), the 1st example contains a series of squares that are coherent with one another. This is disrupted by a chaotic form P between them that is not desirable according to the principle. It would be better if it is replaced with the more coherent form Q as shown in the 2nd example.

Figure 2.26: Coherence principle

1	Not Recommended	2	Recommended
	 <p>A sequence of four shapes: a small square, a medium square, a chaotic, irregular shape labeled 'P', and a large square.</p>		 <p>A sequence of four shapes: a small square, a medium square, a square labeled 'Q', and a large square.</p>

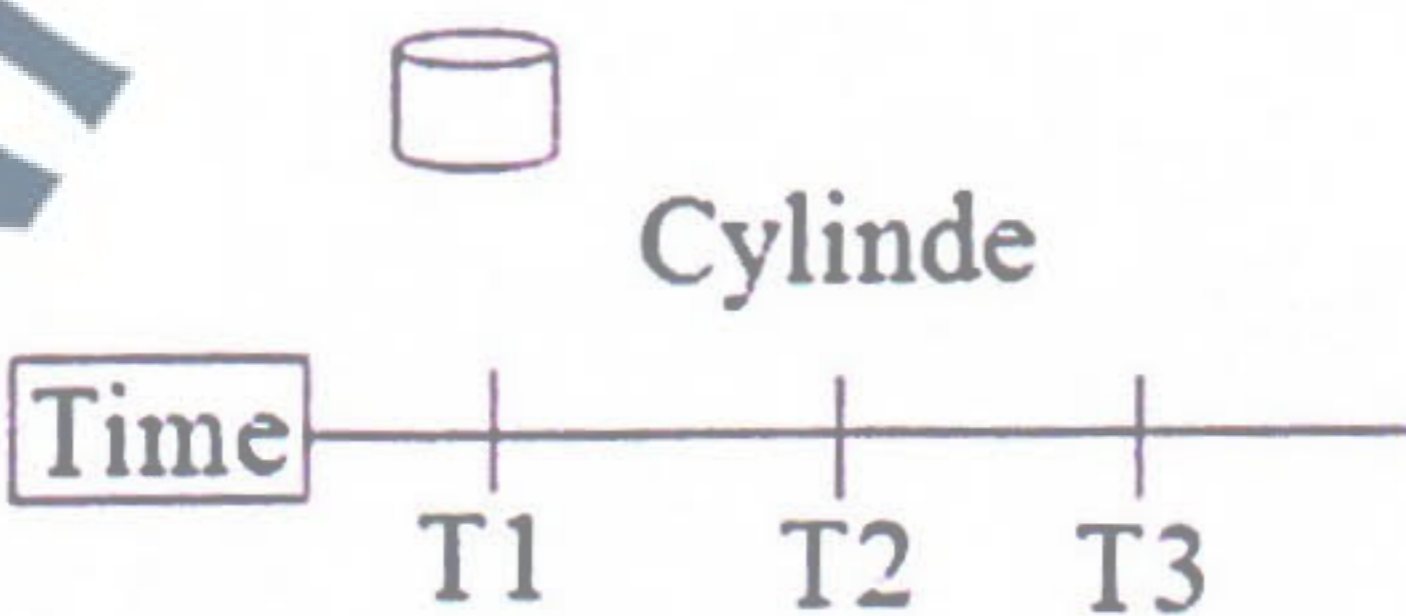
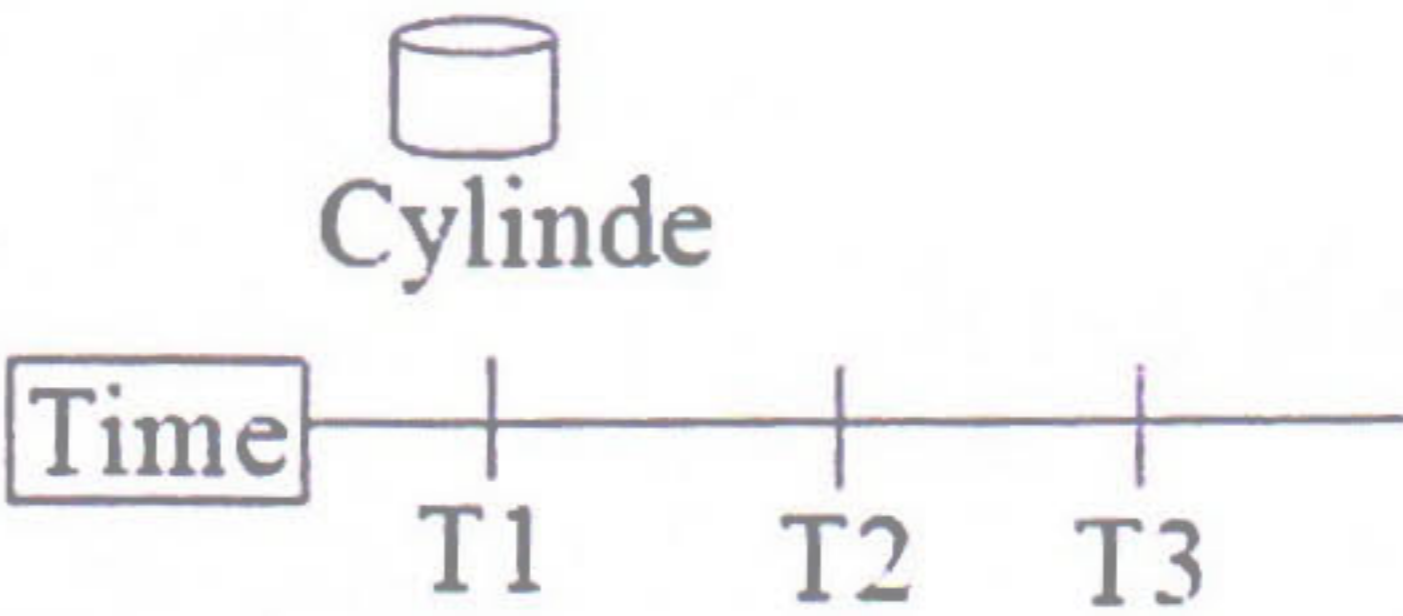
With regard to the location between the text and picture, the spatial contiguity effect (Zayas et al., 2013) asserts that related elements should be close to each other instead of further away. Try to observe carefully how the word “triangle” in the 1st example is displaced rather distant from the shape as opposed to the 2nd example of which it is positioned very near to the bottom in Figure 2.27.

Figure 2.27: Spatial contiguity principle

1	Not Recommended	2	Recommended
			

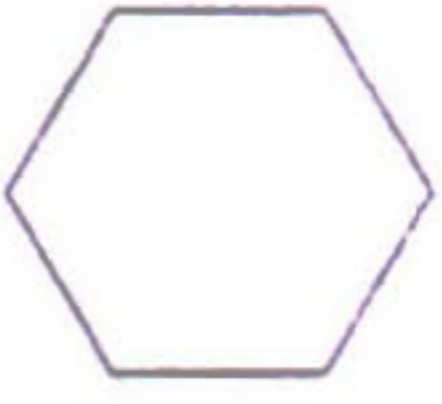
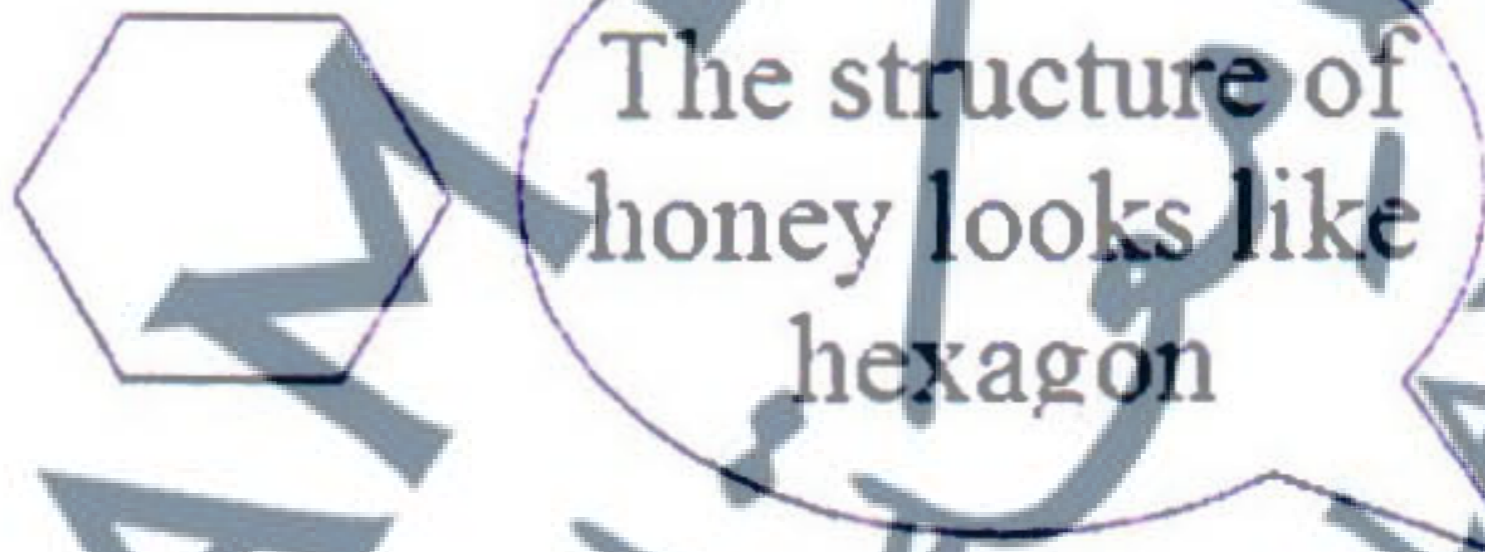
Proximity is also recommended for the case of related texts and pictures in terms of time. The temporal contiguity effect (Mayer & Moreno, 2002) implies the need to display them simultaneously instead of successively. Suppose an animation is made (Figure 2.28) to teach the concept of a cylinder with the time **T1**, **T2** and **T3**. It is not recommended to show the shape and then the wording subsequently (1st example). Instead, a simultaneous display is preferred (2nd example).

Figure 2.28: Temporal contiguity principle

1	Not Recommended	2	Recommended
			

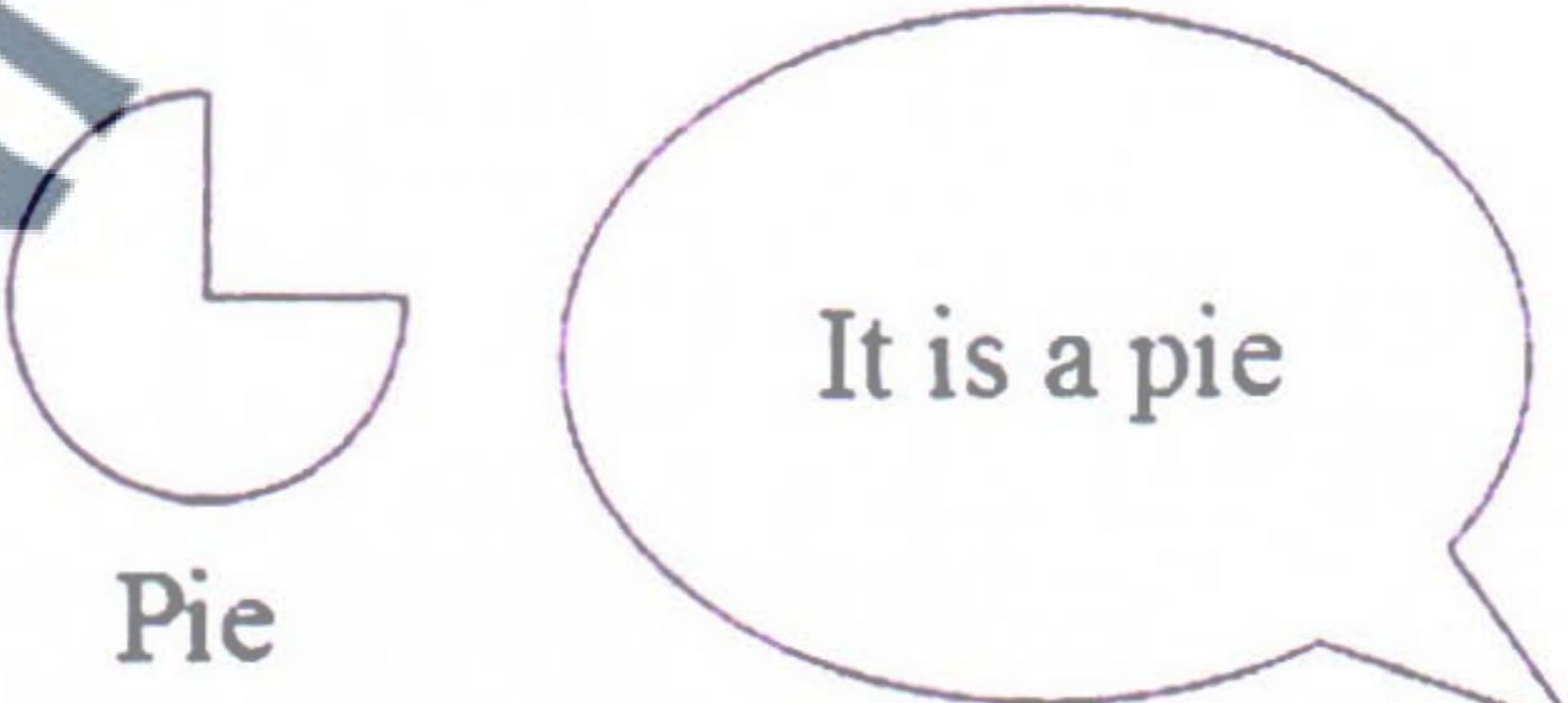
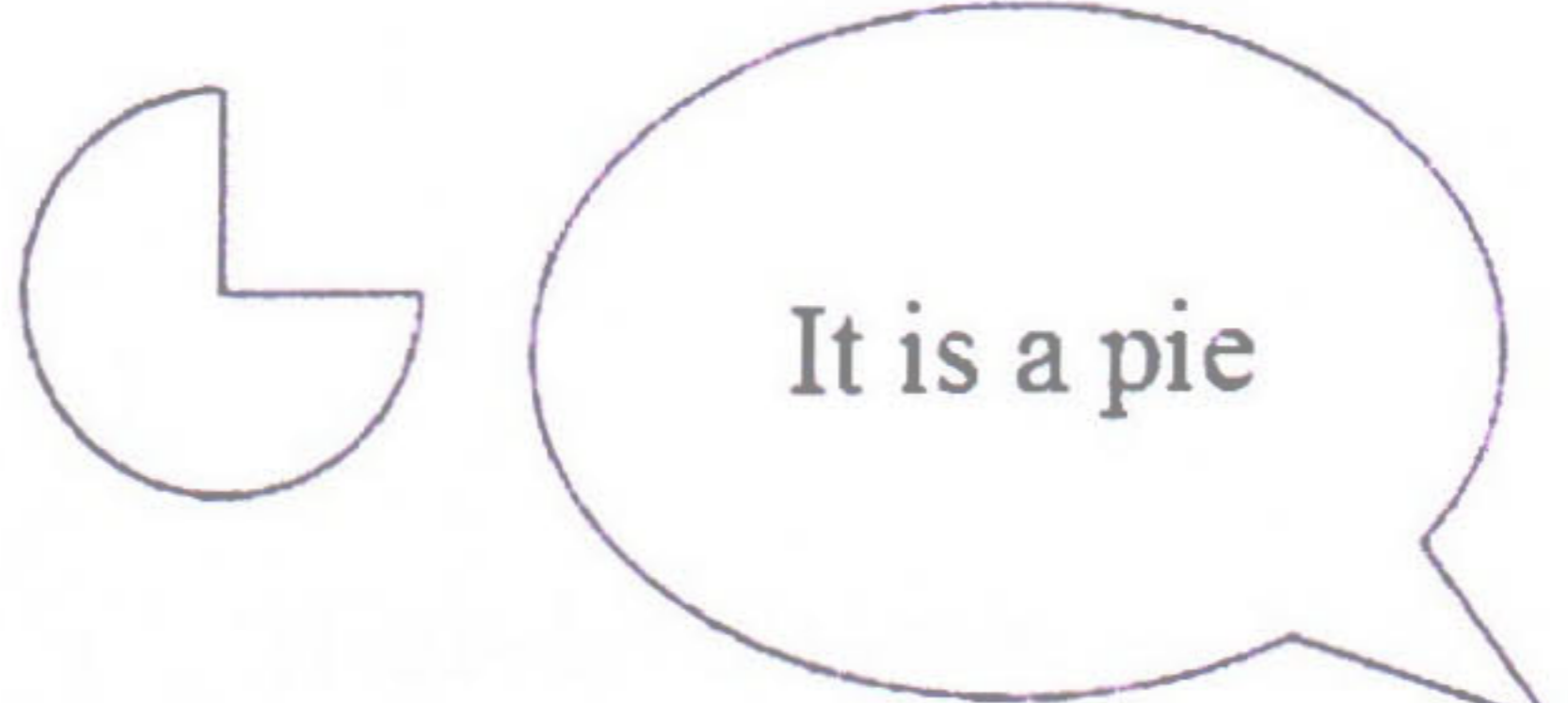
Concerning the competition between the elements of textual representation and verbal narration in being coupled with animation, it is deemed that the latter is superior by the modality principle (Crooks et al., 2012). This means that it is better to exhibit an animation with oral explanation (2nd example) as opposed to the one with textual elaboration (1st example) as demonstrated as shown in Figure 2.29.

Figure 2.29: Modality principle

1	Not Recommended	2	Recommended
	 <p>The structure of honey looks like hexagon</p>		 <p>The structure of honey looks like hexagon</p>

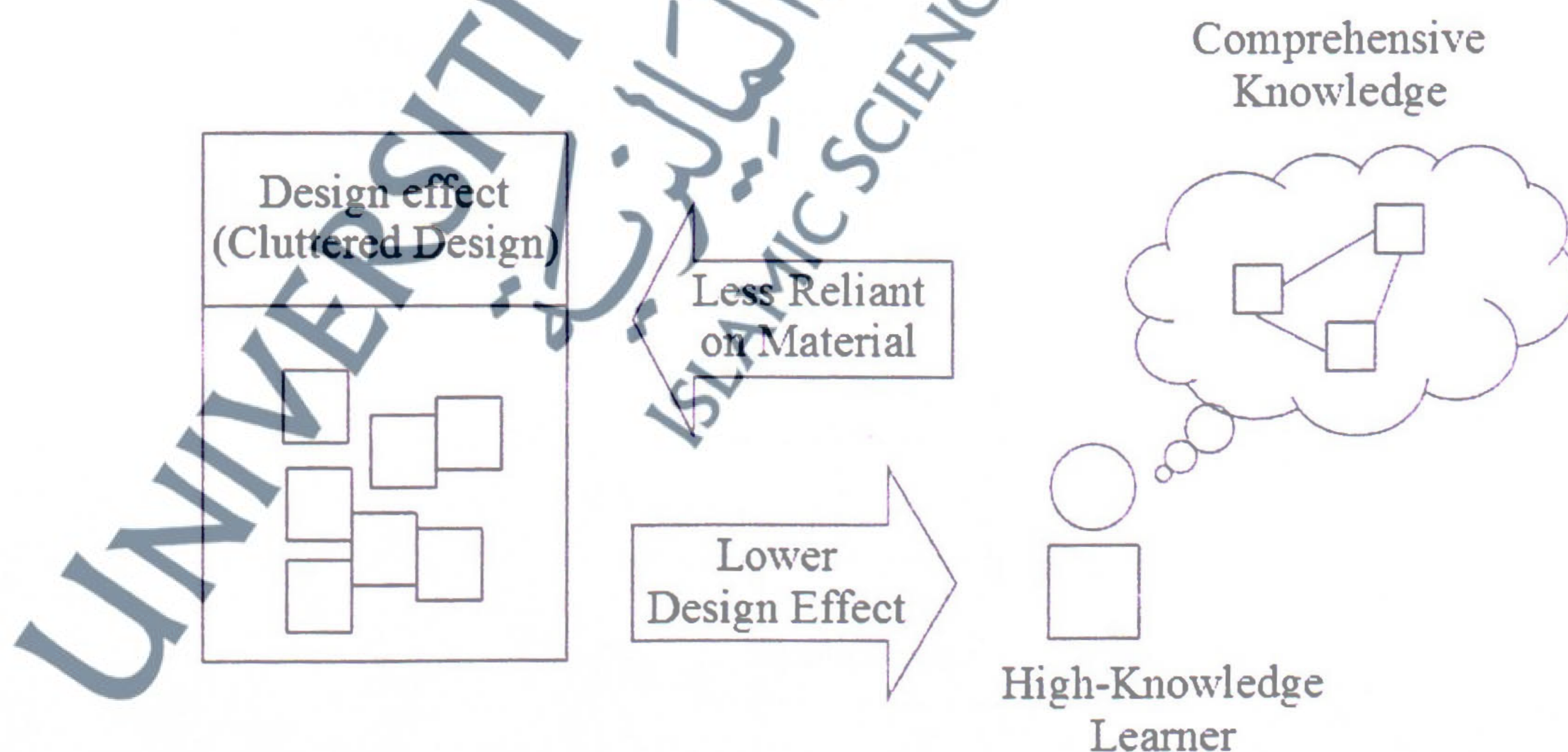
The redundancy principle (Schüler et al., 2013) however, contends that there should not be any redundancy between the modality of elements. To illustrate this particular principle, compare the two cases in the left and right example below (Figure 2.30). In the 1st example, the word “pie” is redundant with the spoken narration “it is a pie”. This is not recommended. On the other hand, there is no redundancy in the 2nd example. Therefore, it is better.

Figure 2.30: Redundancy principle

1	Not Recommended	2	Recommended
	 <p>Pie</p> <p>It is a pie</p>		 <p>It is a pie</p>

The last principle, known as the individual differences principle is concerned with the spatial and knowledge tendency of the learner and the extent to which it is affected by the design effect. Practically speaking, the design effect (Plass et al., 2014) denotes the impact of design on the learner, for instance, the way how aesthetics can affect mood (Heidig et al., 2015) and comprehension. Design effect is proportionate with spatial affinity. It is stronger for high-spatial learners as compared to low-spatial ones. Therefore, visual learners are more affected by design effects when contrasted with audio or kinesthetic ones. Any form of inferiority in design may stymie their positive perception of the lesson, for example, a design with cluttered objects which is not recommended. Unlike the previously mentioned correlation, design effect is inversely proportionate with knowledge. It is weaker for high-knowledge learners as opposed to low-knowledge ones, perhaps, because high-knowledge students have a more comprehensive internal representation of the lesson (Parry, 2010). Thus, it is less reliant on what is shown on screen, so it would be less affected by the cluttered design (Figure 2.31).

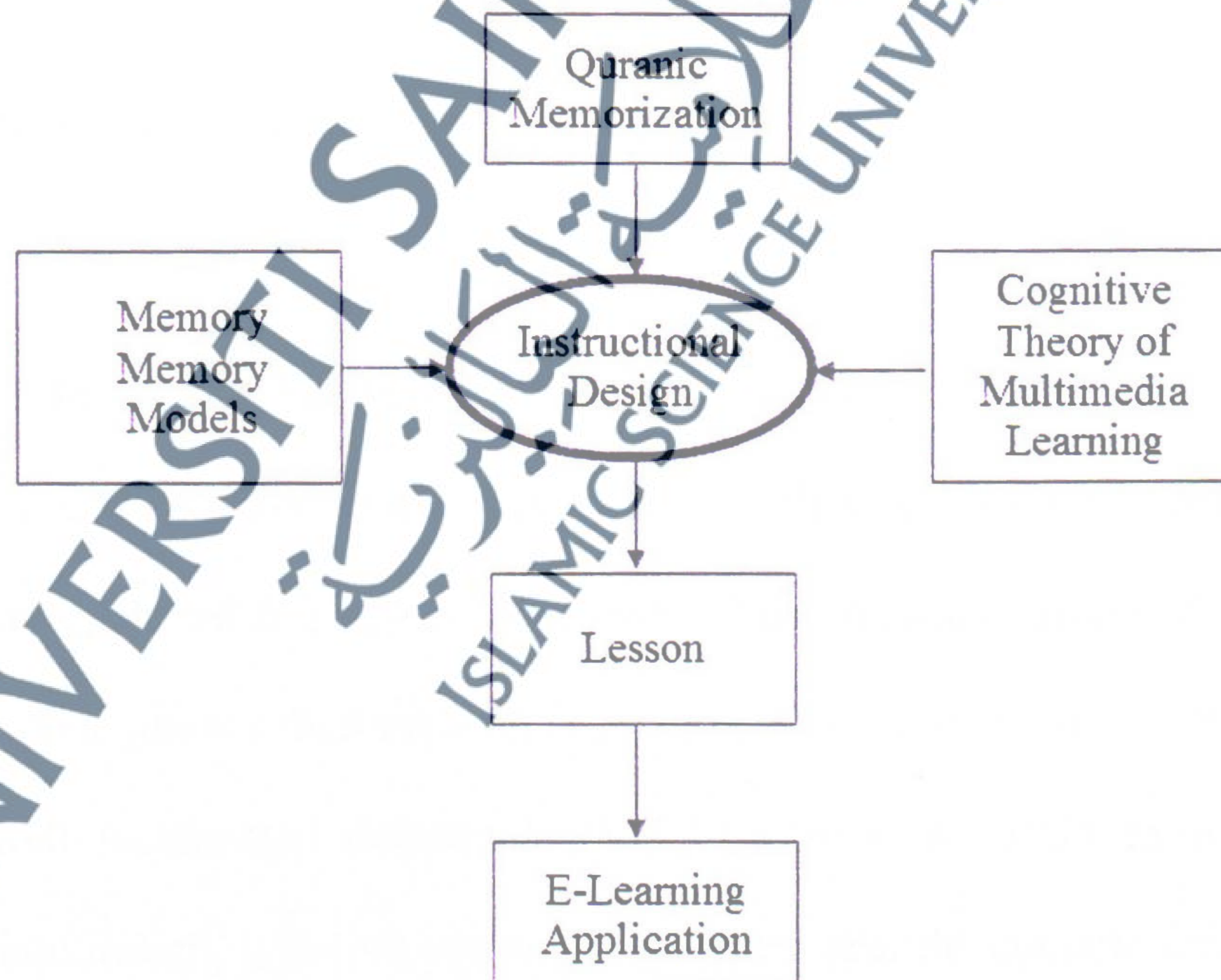
Figure 2.31: Design effect on high-knowledge learner



2.5 Instructional Design

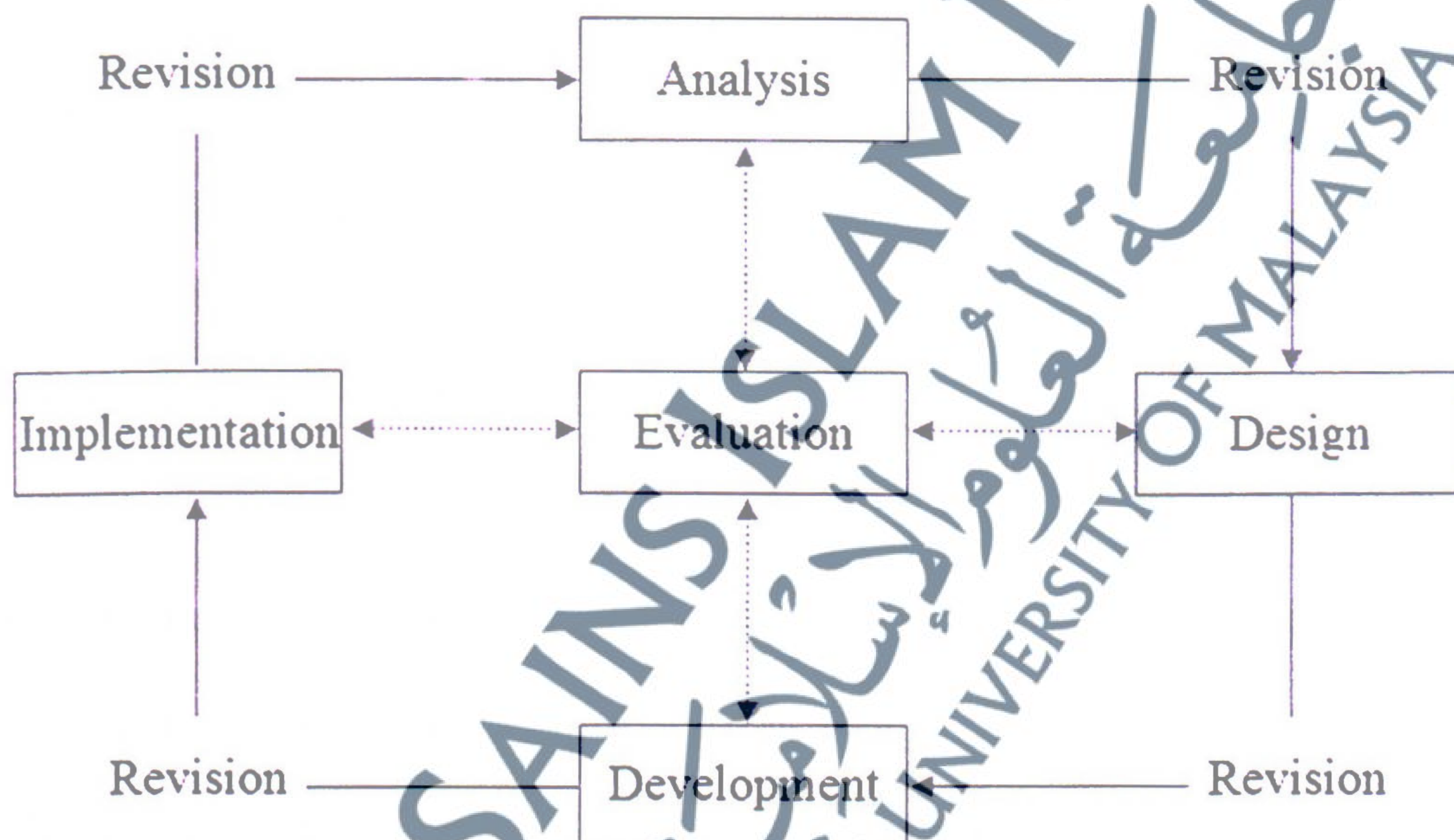
Instructional design (Sangsawang, 2015; Alias et al., 2013; Khodabandelou & Abu Samah, 2012) is a method of materializing a particular learning experience with the goal of optimizing its efficiency and effectiveness. Relating it to this research, the targeted outcome is to improve the process of Quranic memorization. Therefore, it must be able to synergize the collection of previous findings on memory, memory models and cognitive theory of multimedia learning to produce a lesson that can be converted into an e-learning application (Figure 2.32). The application should enable the students to memorize the Quran better. In this respect, instructional design is the governing process that transforms all the theoretical argumentation into a practical solution.

Figure 2.32: Role of instructional design



The ADDIE model (Cheng, 2011; Carliner, 2003) can be employed for the instructional design of an e-learning application. Its iterative procedure makes it rather useful for practical usage. In effect, it is quite ideal for the rapid development of an online course. As illustrated in Figure 2.33, the model consists of analysis, design, development, implementation and evaluation. Any of the steps can proceed to the evaluation stage, which is the axis of the model.

Figure 2.33: Addie model



One of the hurdles of building an e-learning system is amalgamating the diverse educational and technological components. Conflict is bound to arise when the elements are gathered from different sources. Thus, to ensure sustained consistency, an intermediate phase called revision is performed between the stages. For example, when a well-documented deliverable (Vidal-Castro et.al, 2012) from analysis is funneled into design, it is first revised to guarantee that the consistency and quality are maintained. This reduces the possibility of accumulative error.

Analysis clarifies the goal (Lavasani et.al, 2011) of the learner along with the requirements and tasks to be taken. Therefore, if the learner attempts to memorize a collection of sentences (goal), the approximate time needed for it (requirement) as well as the work involved, say as being able to read the sentences fluently (task), are all determined in the analysis stage.

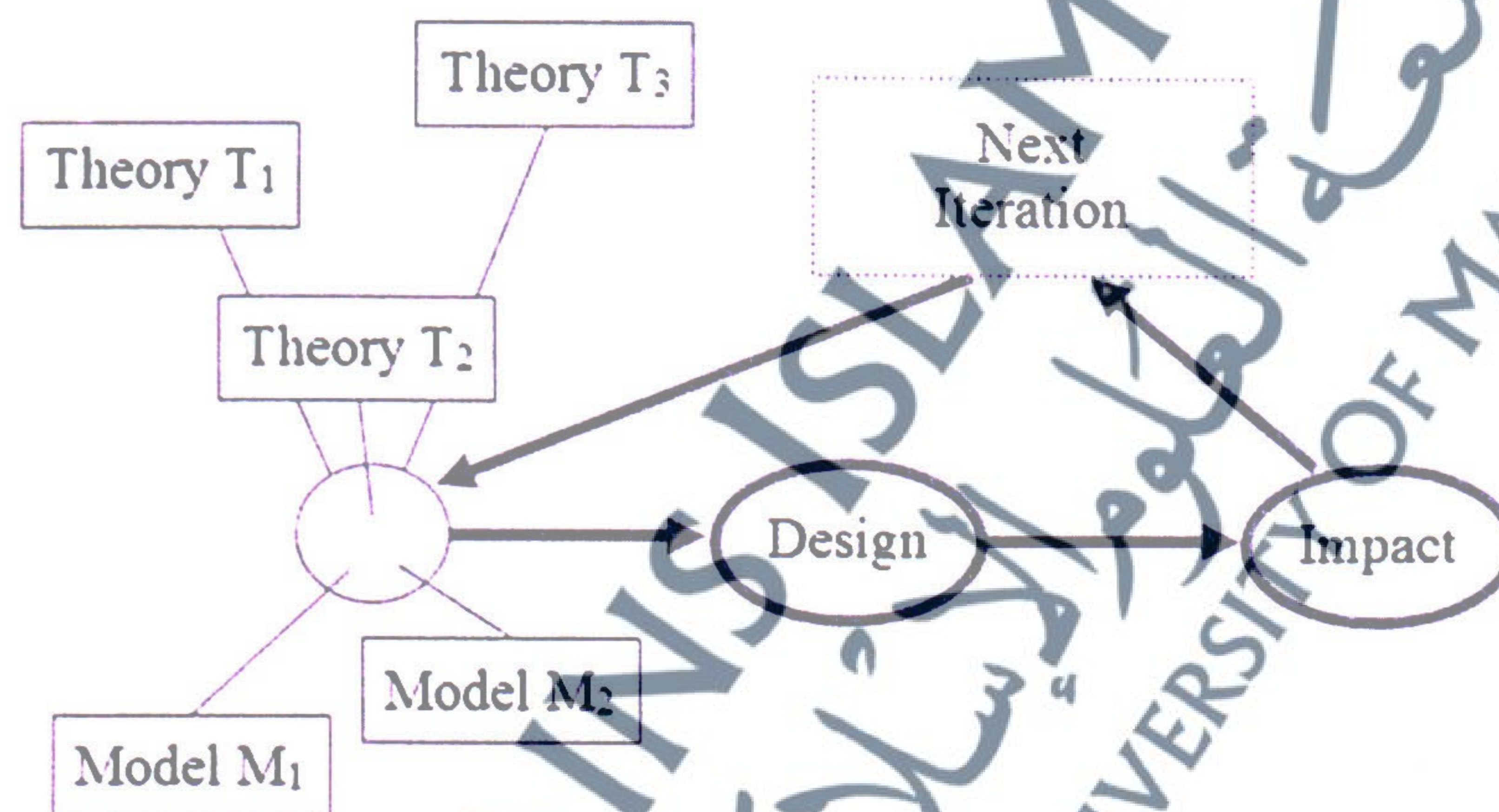
Unlike analysis that defines the general tasks to be done, the design stage specifies exactly the strategy (Kadivar et al., 2011) or how a particular task should be done. For instance, to memorize a sentence with certain efficiency, it would be wise to divide it into smaller parts for practice. Thus, the general task is now decomposed into a set of actions that can be performed by the learner in a proper sequence.

In order to know the most appropriate way of translating a task into actions, it is therefore vital for the design stage to consider the theories and models that could be relevant to the matter at hand. To note, the act of breaking a sentence into smaller parts is related to the principle of chunking (Gobet et al., 2001) in the model of working memory. Besides that, it is also connected to the cognitive load theory.

Forging the optimal design at the first trial can be quite difficult. Theories and models can conflict with each other for realization. For instance, certain theories may suggest reductionism as a wise strategy while others may argue that hybridization as something more fitting. Selection should therefore be attentive to the observable impact of the design towards the learning process of the students. In this sense, it should be contextually grounded.

To illustrate the importance of integration in design (Figure 2.34), imagine the scenario of having to consider the combination of three theories T_1 , T_2 and T_3 with two models M_1 and M_2 . Without the loss of generality, assume that the initial design decides to combine only T_1 and M_2 . In theory, the reasoning appears beneficial but the effect may not be so. The impact is therefore studied (Vogel-Walcutt et al., 2013) and utilized in the next iteration. As mentioned earlier, it is difficult to optimize the design at the initial attempt. Thus, the iterative procedure is commendable.

Figure 2.34: Integrating theories and models in design



Once a design is properly revised, it can undergo the development stage. Here, the real activity (Thaiposri & Wannapiroon, 2015) is developed along with the material that is vital to the intended lesson. As such, if the previous stage imparts the importance of dividing a sentence into its parts, an actual sentence is defined and decomposed in this stage. A record is made on how the decomposition translates into its constituent parts. To recap, this stage converts theoretical assertions into a realistic intervention (Pesova et.al, 2014) for the students.

The deliverable of the development stage should be the actual material (Busstra et al., 2012) or content for the e-learning application. Although the material is not yet in a digitized form, its structure and attributes must be apparent. This allows for the educator to check the lesson thoroughly without the constraints of technology. Emphasis is also given on the overall coherence of the material.

Coding of the developed material is also performed in the development stage. To do this, the educator must rely on technology to attain the desired effect of multimedia. For instance, to represent the sentence breaking process into an animation (Ploetzner & Schlag, 2013) with verbal narration, special software might be needed. This requires the practice of additional skills.

Having the e-learning application, the next step is the implementation stage (Huang et.al, 2007). Here, the e-learning course is deployed to the students and they would use it for actual learning. It must be reminded that implementation is not confined to students alone. If the e-learning application involves the teacher or administrative personnel, then they would be involved in this stage as well.

The implementation stage for e-learning also entails technological evaluation. It is vital for the developers to check that the website for the online course is working as planned. Common performance issues should be dealt with. For instance, when a large pool of students is using the e-learning facility concurrently, extensive delay or crashes might occur. Thus, it is imperative to foresee the possible problems that could happen in order to deploy a contingency plan.

The final stage is evaluation. After using the e-learning system, feedback is gathered from the corresponding users. Two kinds of assessment can be employed, either the formative or summative assessment. Formative assessment evaluates the e-learning application whereas summative assessment ascertains the performance of the students after learning the course.

Formative assessment (Gikandi et.al, 2011) can help to improve the overall teaching and learning experience that is offered by the e-learning system. For instance, the online content could be too complex for the students to understand. Therefore, it should be simplified into a series of levels with increasing complexity. This way, students can easily digest one level before going to the next.

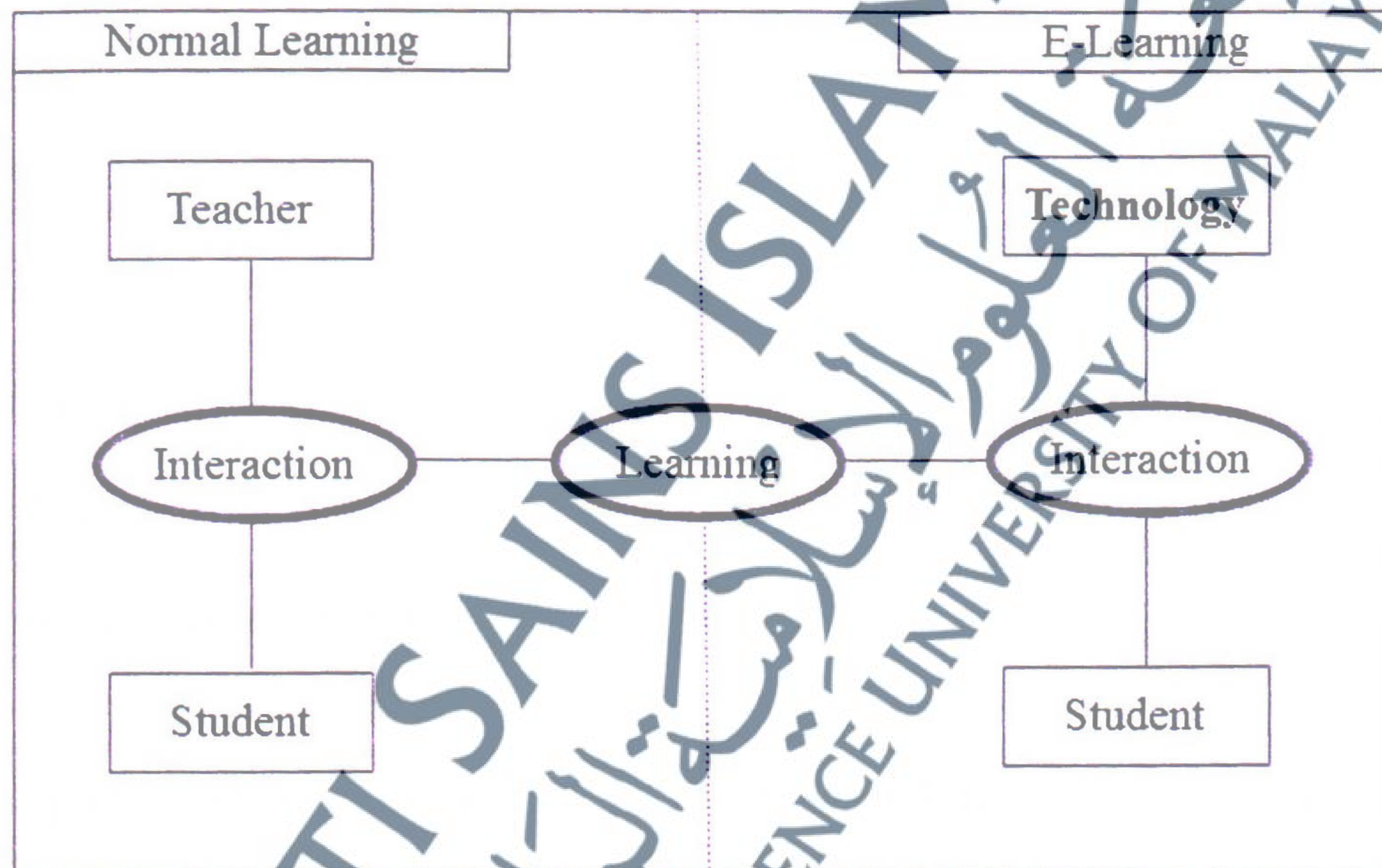
Compared to the previous one, summative assessment (Marriott & Lau, 2008) attempts to determine the achievement of the student for the subject. It compiles the marks given for each category of performance evaluation into a specific overall grade. For instance, the marks for assignment, quiz, test and examination are combined to decide whether the student passes the course or not.

Both assessments do not exist in isolation. If the formative assessment reveals a high score but the summative assessment does not, then it can be rationalized that the design of the material for the e-learning course is superior. However, it may lack sufficient practice questions (Yang, 2013) that can prepare the students better for the exam. Findings gathered from formative and summative assessments can therefore be used to ensure a high quality learning experience for the students.

2.6 E-Learning

Learning normally occurs between two parties of which the teacher and student interact with one another for the transfer of knowledge, attitude and skill to transpire (Cervetti et.al, 2015). The teacher provides the student with guidance on how best to learn. This includes deciding the goal of learning (Koopman et.al, 2014), compiling the relevant materials, defining the skills to practice, as well as developing the test to be passed.

Figure 2.35: Normal learning vs. E-Learning

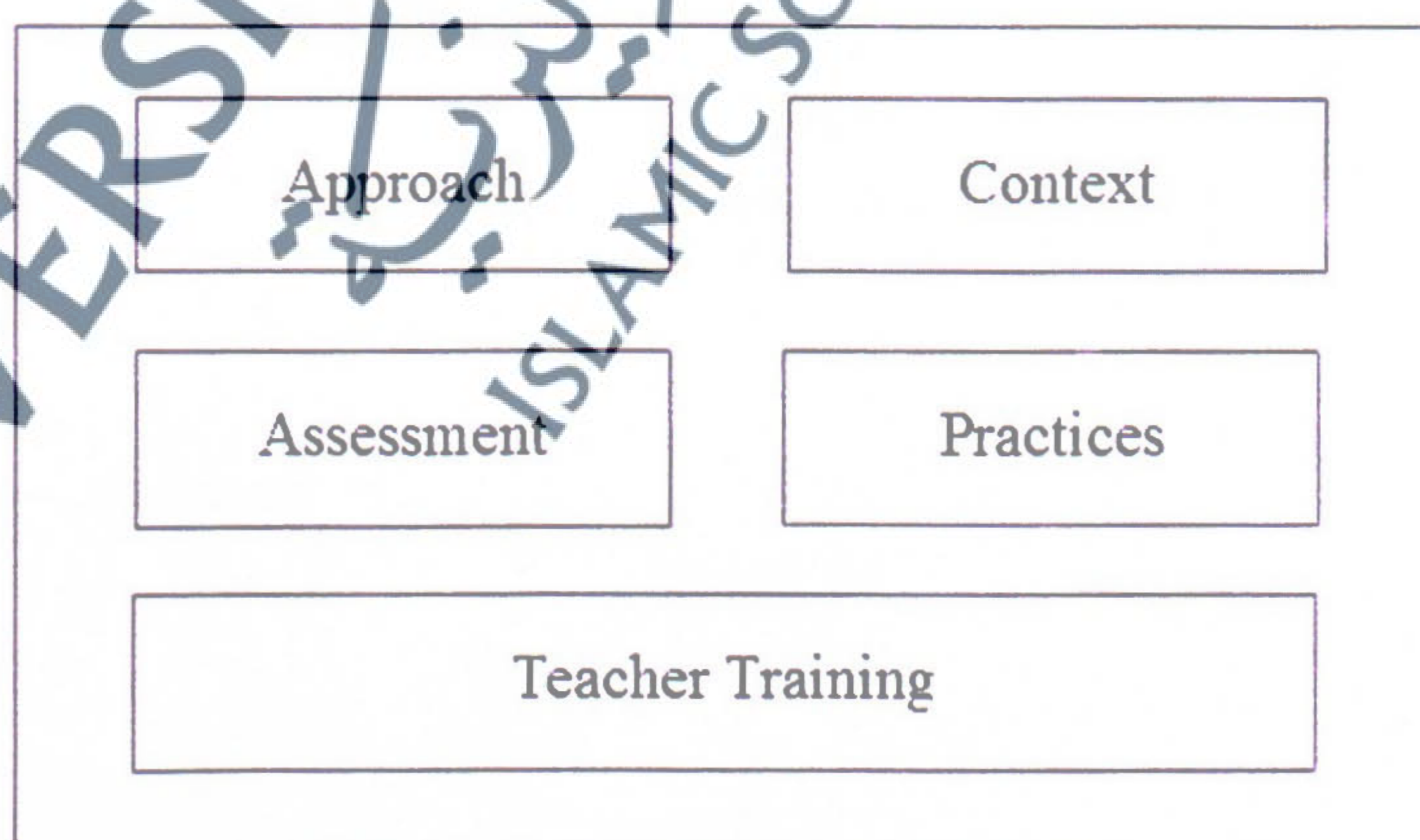


E-learning (Bhuasiri et al., 2012) on the other hand, takes away the role of the teacher and replaces it with technology (Figure 2.35). The students no longer engage the teacher to learn. Instead, they interact with the computer to acquire the outcome of education. This is often facilitated online, whereby the components of learning such as the goal, material and test would reside within a website in the internet.

2.6.1 Framework

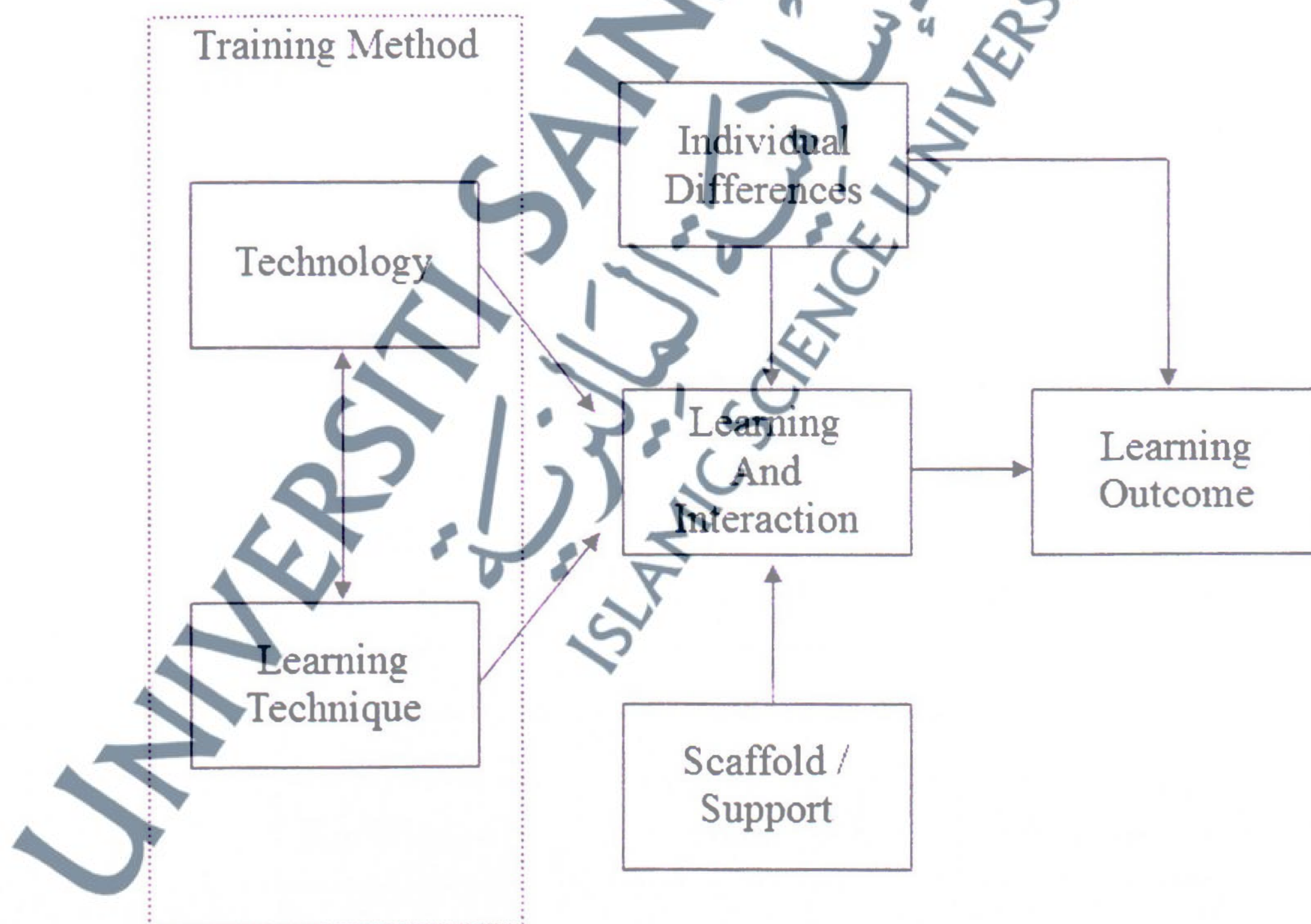
Various frameworks for e-learning (Milkova & Hercik, 2014; Rui & Maode, 2012; Beldagli, B. & Adiguzel, 2010) are proposed within the literature. One of them is the pedagogical framework (Granic et.al, 2009) that recommends five main components of e-learning (Figure 2.36) namely the approach, context, assessment, practices and teacher training. The approach that covers the method of e-learning should promote active learning and autonomous engagement. The context that signifies the interaction between the students and the system must extend beyond passivity. Assessment is basically the manner of which evaluation will be conducted. There are four types of assessments proposed in the framework, oriented by the computer, self, peer and tutor. Practices are the educational norms that are consistent with the nationally specified standards and practices. The e-learning system must reflect the national requirement to be effective at the learning institution. The last component is teacher training which takes into consideration the development of skills required to support the teachers in the usage of e-learning for teaching.

Figure 2.36: Pedagogical Framework (Granic, Mifsud & Ukusic, 2009)



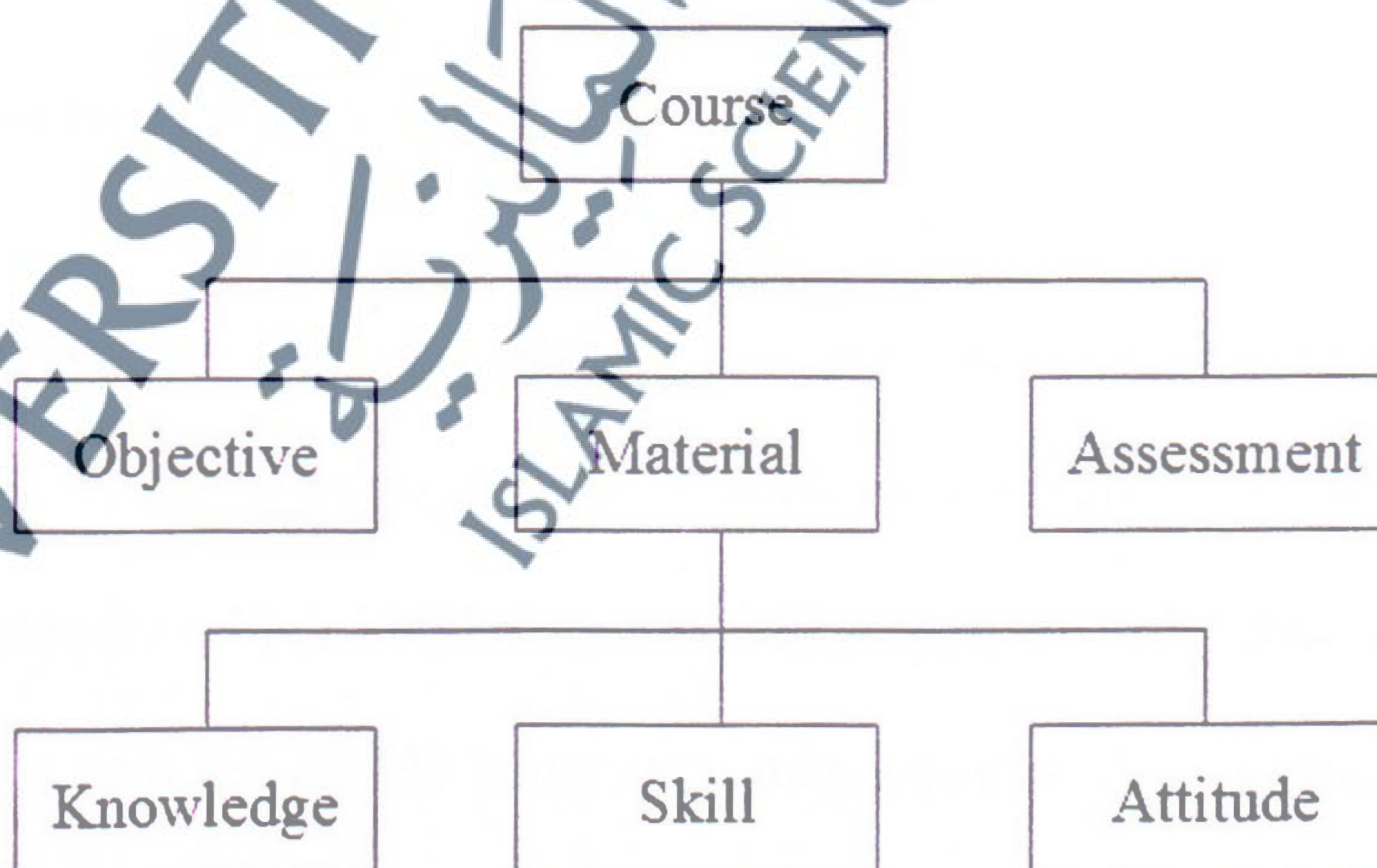
Another interesting framework for e-learning is the EUT Framework (Ramakrisnan et al., 2012). The framework (Figure 2.37) decomposes training or teaching method into technology and learning technique. Here, the technology defines the reliance of the students on the computer. In other words, whether the student is learning from the computer or with it, such as the case of blended learning. Two kinds of learning techniques are explained. They are individual vs. group learning (Draghici et al., 2014) and instructor vs. self-paced. These two components would cohesively impact the learning and interaction process that is central to the framework. Individual differences such as the traits and states are also encapsulated for a better personalization. The component that facilitates the scaffolding / support is included as well. All these components eventually lead to the learning outcome (Koraneekij & Khlaisang, 2015).

Figure 2.37: EUT Framework (Ramakrisnan et al., 2012)



A simplistic framework for e-learning is given in (Figure 2.38). A course would consist of three major elements – objective, material and assessment. The objective clarifies the learning outcome to be achieved by the e-learning experience. All the resources needed for the students to learn are covered within the material element. This includes textual, verbal and visual contents that are designed to accommodate with the different learning styles of the students. It is reasoned that each material will contribute to either the knowledge, skill or aptitude of the students, which is congruent with the outcome based education (Akir et al., 2012; Eng et al., 2012). For instance, in learning about Islamic civilization, the material would offer knowledge on its commencement such as the inception of Islam. This is further consolidated with the associated skill such as the ability to provide a chronological enumeration of the events that cause civilization. Apart from that, it should also induce the right attitude within the students. For example, a better sense of appreciation on the role of Islam towards civilization. Eventually, the students should be properly evaluated to allow a realistic conduct of assessment (Yastibas & Yastibas, 2015).

Figure 2.38: Simplistic E-Learning Framework



2.6.2 Implementation

A number of open source platforms are available in building the e-learning system. Among the popular ones are Moodle (Barge & Londhe, 2014; Costa et.al, 2012), LRN (Banday et.al, 2014), eFront (Batista et.al, 2013), Sakai (Muñoz et al., 2015), A Tutor (Cavus & Zabadi, 2014) and OLAT (Iannucci et.al, 2011).

With the open source platforms, it is possible to implement the e-learning system quickly. All of the main functionalities, such as adding a video or defining the course structure, are already provided within the package of these platforms. As such, it is rather easy to build a course online. In fact, development can be directed mostly on the compilation of educational content without being hampered by technological issues.

To learn a particular subject, the students need only to login into the e-learning system and register for it. The entire course content will then be available. Students can learn through the material at their own convenience and then do the quiz and practice test for mastery purposes. There is constraint, however, to the final deadline of which the course must be completed.

Feedback is a necessity in active learning (Benta et.al, 2014). In e-learning, students can obtain this by looking at the analysis of their overall performance. This way, they would know exactly which knowledge or skill is praiseworthy and which is sorely lacking, which in turn, can enable better time management. A more focused effort can then be directed towards improving weakness in a certain topic instead of restudying the entire material.

Certain e-learning platforms also promote group learning. Students can discuss a topic in a forum (Reis et al., 2015; Martinho et.al, 2014) by posting their questions there. Other students from the community will provide assistance by browsing through the questions and providing the most probable answer. Here, they are encouraged to promote interactions in learning.

Apart from learning, performance evaluation is conducted online as well (Llamas-Nistal et al., 2013). For example, in doing examination that involves multiple choice questions, the students can take the test and then attain their grades almost immediately after. This optimizes the process of exam management tremendously and allows the educators to focus more on delivering the best learning experience.

One of the major issues of deploying e-learning system is the security (Costinela-Luminita & Nicoleta-Magdalena, 2012). With nearly everything done online, it is extremely critical that the system is not compromised. Otherwise, the entire integrity of e-learning would collapse and the educational achievement that is gained online is no longer perceived as meaningful or valid.

To conceptualize the danger of security exploits, consider the Moodle e-learning platform that is programmed in PHP. The system could be vulnerable to session hijacking (Costinela – Luminita, 2011) of which the attacker can resume control over the access of another student. This implies that the attacker can sabotage the examination that is taken online.

In order to enforce a much stronger protection against hacking, a multitude of defensive strategies are devised. Highly sensitive information such as the examination questions should be encrypted (Thangavel et al., 2015) and stored within a fortified server. This makes it harder for the system to be penetrated. Furthermore, even if the encrypted information is stolen, the perpetrator would not be able to read the content and cheat in the exam.

Securing e-learning application is a formidable agenda with the rising popularity of the hacker culture (Kao et.al, 2009). Insidious tools for hacking are widely available and more hacking incidents are now detected in the internet. Perhaps this is exacerbated when adolescents are conditioned by their peers to believe that their destructive actions are seen as something laudable.

2.6.3 Strength and weakness of e-learning application.

The potential of e-learning is very promising. It frees the students from the boundary of formal education that is innately tied to spatial and temporal constraints. Unfettered by the classroom, e-learning allows the students to learn a subject from anywhere, at any time of the day (Alenezi & Shahi, 2015). This positions education to a higher level of flexibility.

To demonstrate this flexibility; imagine a student who are living very far from the school. He is rather weak but the cost of commuting to the school prevents him from taking the extra classes during the weekend. With e-learning, he may connect to a learning website to progress in his study (Pieri & Diamantini, 2014). There is no need to commute to the institution. He can study from his own room.

Besides the spatial benefit, the temporal advantage is very convincing as well. The student is given the luxury to learn at a convenient time and pace. Supposed the tuition classes are organized at a time that clashes with other obligations, the student can decide to assess the e-learning facility at another time when he is free. This actually empowers learning to greater heights.

The different rate of progress in learning (Kohli et al., 2015) is also a non-issue for e-learning. In a normal class, the teacher would usually have to balance the speed of teaching between good and poor students. Poor students may suffer the apprehension of requesting the teacher to repeat a lesson that evades their understanding. With e-learning, the poor students can repeat the lesson as frequently as they wish. They are not causing delay to anyone.

Although the strength of e-learning can be quite persuasive, its drawback is apparent as well. Technology can never really replace the role of a teacher (Deris et.al, 2012). This is especially true when it comes to the issue of humanity of which the e-learning system can never possibly emulate. The bond between a teacher and the students evolves beyond intellectual pursuit. A true teacher can inspire students to become better in life.

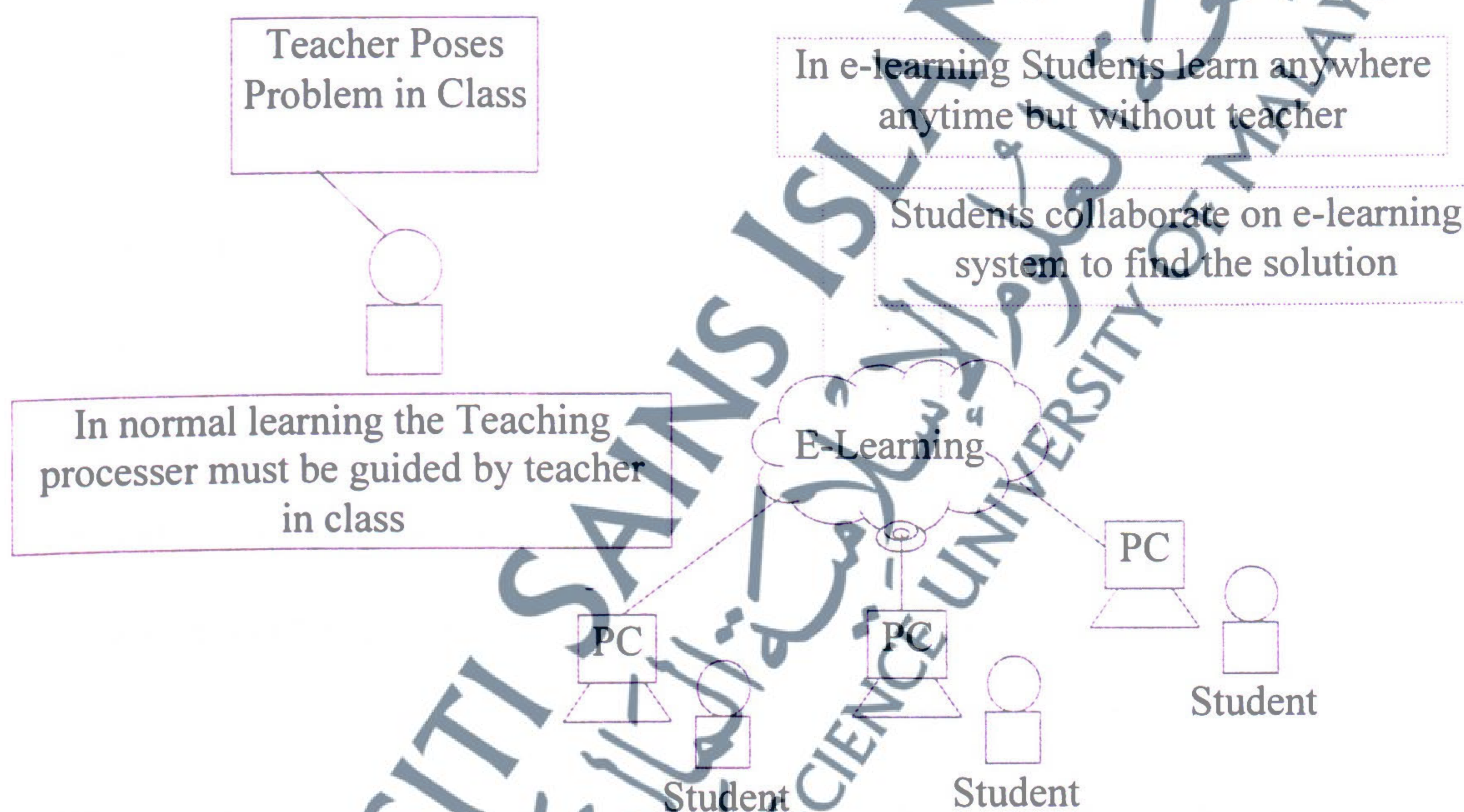
For instance, suppose a student has failed an important test and feels emotionally decimated. Technology cannot offer the morale support that he needs. It might be able to report the possible weakness of the student through a certain analysis. However, the e-learning system would not comfort him. Only a real teacher can offer a helping hand and show sincere care. Only another human being can give a wise advice on how to move forward in life (Rymes, 1996).

Furthermore, e-learning cannot adapt to the changing demand of education as dynamically as a teacher would. Students evolve through time and may inquire different kinds of support as they progress deeper into the lesson. To quote an example, a student who is just beginning to study mathematics might need help on how to perform calculation. Later on, the thirst for assistance could shift more towards abstract reasoning and planning. E-learning is not as adaptive as this. It does not have the mechanism to improvise beyond what is programmed.

2.6.4 Blended Learning

Realizing the limitations of e-learning does not imply its trivialization. Instead, it simply highlights the need for cooperation between normal learning and e-learning. This promotes the emergence of blended learning (Bower et al., 2015) of which both types of learning occur together for the benefit of the students. With blended learning (Figure 2.39), certain lessons are covered in class, as per the usual way, while others are gained through the technological infrastructure (Krasnova, 2015).

Figure 2.39: Blended learning



Blended learning presents the advantages of both normal learning and e-learning (Siew-Eng & Muuk, 2015) and prospers as one. The students can be motivated by the teacher in class when dealing with a particular impasse in learning. Alternatively, they can enjoy the versatility of education on a daily basis without being dissuaded by the constraint of time and place. Thus, learning can be a lifelong agenda that is tailored for all (Mutlu, 2015).

2.7 Interactive Multimedia Architecture and Learning

The design for the multimedia application is derived from models used by renowned psychologists; these models contain Mayer's Cognitive Load in Multimedia Learning (Mayer, 2001). Instruction entails careful blending of planning, task analysis, experience, intended audience and technical consideration.

On the other hand, Dijkstra, (2004) states that instruction as a medium of communication among participants and the educator. The tutors ought to recognize that a perfect instructional design can offer a new life to our conventional classroom instruction, Faryadi, Q, 2012).

Instructional designers must realize that technology help arouses the young to learn elastically, imaginably and meaningfully. In other word, the culture of our classroom, which has led the learners for several decades, necessities to be redefined to produce an environment where participants are satisfied and reveled in their learning in a serious manner (Rosman, 2006), Faryadi, Q, 2011), 2012).

The principal aim of instructional design is to aid society to learn better. It offers a set of process for an effective and efficient learning. In addition, it provides explicit ways for students on how to accomplish excellence in their educations as well. However, instruction should improve participants' new knowledge and authorize them to practice the new knowledge (Faryadi, Q, 2012).

2.8 An Evaluation of Multimedia Learning Tools in the Markets

The evaluation in the present research is directed to analyze the effectiveness and efficacy of the Arabic multimedia applications in the markets in a critical way. In this evaluation of Arabic multimedia, applications were studied based on the theories of the many highly qualified and vetted psychologists such as Mayer's (2003) "Nine Ways to Reduce Cognitive Load in Multimedia Learning", Gagne's (1985) "Nine Steps of Instructional Events", Keller's (1988) "ARCS Model of Motivational Design" and Reigeluth's (1999) "Seven Steps of Elaborative Theory of Instructional Design"; Faryadi, Q. (2009). Additionally, the current study used a pre-decided specific and general checklists which are (Checklist for a General Review and a Specific Review of the Arabic Multimedia Application in Markets of Malaysian as shown in Appendix 1,2) based on many models such as Mayer's (2003), Seci Model, Addie Model, Noordin S., et al, (2011) Instructional Design Model; in order to study the integrity of the Arabic applications to teach participants how to memorize the Holy-Quran, available in the Malaysian market (Appendix 1 & 2).

The study identifies thirteen Arabic teaching applications of the Holy-Quran in the market. Thereafter, these applications were categorized into three main categories based on its relevance to primary school students and participants in grade five based on the age range from 11 to 15. Some multimedia applications were marked as improper because the application was too advanced for students in this age and transferred to their level or it was in a different language.

The content of these applications are not suitable for Libyan school standards. The study also indicated that some of the Arabic applications were marked as repetitive as in Table 2.2. As a result of these categories, 10 teaching materials were marked as improper for Libyan school students in grade five to teach participants how to read and memorize the Holy-Quran in the proper way. The remaining three Arabic teaching materials were marked as related and thus, meticulously evaluated to determine whether these applications meet the requirement of a good teaching design to teach the Holy-Quran.

Table 2.2: Categories of Arabic multimedia application for teaching al-quran

Category	Application Name	Reference	Strength	Weakness
Computer based	Nour Elbyan	http://midade.com/Media/Software/NOUR_ELBYAN2.rar https://archive.org/download/anas5002/nooralbyan.iso http://www.mediafire.com/view/jeeqq.../noorbiana.pdf http://www.archive.org/details/noorbiana3	Uses ayat and help participants to learn how to write some word in quran with harakat.	Focus on learning Arabic. Not suitable to teach al-quran.
	BianAjmy	http://www.archive.org/download/www...ianAjmy_cd.exe http://www.archive.org/download/asfoura15/BianAjmy.iso	Offer memorizing full verse. Can search about any particular ayah.	it does not teach Arabic alphabets Not suitable to teach al-quran because there is no steps to learn from it.
	Quran Memorization Cd	http://www.fayoume.com/vb/showthread.php?t=30768	Anyone can find the ayat that need to be memorized by repeating the ayat many times.	Not suitable to teach al-quran because there is no steps to learn from it.
	اسطوانات لتعليم قراءة القرآن Alqrat	https://bookets4allstages.blogspot.my/2015/08/blog-post_67.html http://www.mediafire.com/download/cqpwat4a218098v/_...7z http://archive.org/download/talym1/alqrat.iso	The application concern in teaching how to read and write Arabic letters.	The application did not concern on teaching quran.
	Cd1atfale	http://www.archive.org/download/cd1atfale/qurqan.iso	The application can be used to teach quran and memorize.	The application uses Traditional way of teaching
	Arabic Letters	http://bramegm.com/software/files/Prog12/ArabicLetters.zip http://bramegm.com/software/files/soft56/ArabicLetters.zip http://www.restfile.com/wqsnu0n0iofa/ArabicLetters.zip.html	The application teaches Arabic letters.	Did not use verses from al-quran.
	Tajweed	http://bramegm.com/software/files/soft63/tajweed.exe	The application teaches tajweed.	
	Mohaffez	http://bramegm.com/software/files/soft63/Mohaffez.exe http://www.restfilee.com/ynmza09gdywc/Mohaffez.exe.html	Can be used to memorize al-quran and repeat any ayat many times.	Still using traditional manner.

web based	Quran4u Mohaffez	http://www.quran4u.net/New_Local.aspx http://www.quran4u.net/Learn-Telawa.html	Provide digitalization, can search for any ayat, verse or even word. Can be used to teach and learn quran anywhere anytime.	Still using traditional manner.
	Mo3lm.3ma.Tb ark.Sam3	http://filefreak.com/file/555910051/Mo3lm.3ma.tbark.sam3.nrg		
	The Noble Qur'an	https://quran.com/		
	Mushaf Medina 1	http://www.quranflash.com/books/Medina1/?en		
Mobile Based	Teaching kids the holy quran	https://play.google.com/store/apps/details?id=air.Teaching.Kids.the.oly.Quran.A4enc	The application helps to learn quran using traditional manner.	The current mobile applications still use traditional way of learning and teaching al-quran, some of them providing repeating any ayah but did not use the memorization by pointers.
	تعليم القرآن للاطفال	https://play.google.com/store/apps/details?id=com.akadev.ta3lim.quran		
	عدنان معلم القرآن	https://play.google.com/store/apps/details?id=com.tagmedia.adnan		
	Learn quran for kids - hifd	https://play.google.com/store/apps/details?id=com.learnquranforkids.apprendrecoran.atfalkoran		
	عدنان معلم القرآن للاطفال	https://play.google.com/store/apps/details?id=com.ta3lim.al_quran.lilatfal.adnan.mo3alim_9oran		
	Learn the quran for children	https://play.google.com/store/apps/details?id=com.coranatfal.apprendrecoran.tahfidalquran		

2.8.1 Content and Design Analysis (Nour Elbyan)

The Nour Elbyan projects beautiful graphics on the screen. Unfortunately, the students' memory is overloaded. The sounds and graphics occupy most of the screen. Hence, this window has just exceeded the processing capacity of immediate memory of the student. This study concludes that students learn better if all redundant information is omitted from the teaching (Mayer, 2003). See screen shot of Nour Elbyan in Figure 2.40.

Figure 2.40: Nour Elbyan



Another window from the Nour Elbyan also projects that there are no long verses to use with the graphics. (Figure 2.40, 2.41) The architect of this application focused on teaching Arabic more than teaching the Holy-Quran and has not taken into consideration the importance of the long verses of the Holy-Quran. The graphical quality of the alphabet is good but, it would have been better if they used the complete Quranic verse. Many subjects and graphics are not related for a productive learning result. An experiential research has found out that relevancy raises motivation (Keller, 2004). See screen shot of the Nour Elbyan in Figures 2.41, 2.42, 2.43, and 2.44 in the Appendix.

The application of Nour Elbyan was produced to teach users how to read and learn Arabic using Al-Quran. However, this software helps users to learn how to read through Al-Quran especially by Words from Al-Quran techniques. For example, reciting from Al-Fatiha to Al-Imran.

2.8.2 Content and Design Analysis (BianAjmy)

The main menu of the BianAjmy looks like a one size fits all information. This window is filled with irrelevant information and has a poor graphical design. This application is neither appropriate for kids nor for progressive learning, especially not for students in primary school. In this application, children's recitation is not used; most of the recitation is done by a particular sheikh (Adult) which did not entertain the young learners. Studies show that learning is impaired by redundant contents, ensuing in a poor performance (Chong, 2005). Studies also found out that fewer but quality learning is better than learning more facts (Mayer, 2001). See screen shot of the BianAjmy in Figure 2.45 in the Appendix.

Figure 2.45: BianAjmy



Furthermore, in the window, the graphics are very poor, especially in color (Figure 2.46). The text seems to be unclear and clashes with the background. Word visibility is very poor. Study has established that students understand better when words are presented as a narration (Mayer, 2001). In addition, in other windows it is clear that the text is not very well organized, the colors are not suitable and do not match. Moreover, the designer allows the recitation without highlighting the text. The sound is good but it does not match the text which can confuse the students between texts and sounds. See screen shot of the BianAjmy in Figures 2.46 and 2.47 in the Appendix.

This application gives users the ability to read, listen and memorize and repeat as many times as they want including highlighting the verses with a variety of colors and listening by clicking on the particular verse. They also have included natural pictures so users can enjoy watching, while they are listening to the Holy-Quran. Furthermore, users can put a sign on the verse so they can return and revise; the name of the surah is shown at the top of the page.

2.8.3 Content and Design Analysis (quran memorization cd)

This window is the main menu of the quran memorization cd and it works on auto run with the sound. The background sound and motion objects attract students' attention to this application. Simplicity is one of the best principles of good teaching (Lebow, 1993). See screen shot of the quran memorization cd in Figure 2.48.

Figure 2.48: quran memorization cd



In some windows the menus appear in English (Figure 2.49), Arabic (Figure 2.50) but the font size and type do not correspond. In addition, the colors are not suitable and it could interrupt the concentration of the students. Students learn more when they are given less in a general way of design (Subbar, 1999), Faryadi, 2009). The design itself is very simple and there is no cartoon graphics on the screen to attract students' attention. Simplicity is one of the best principles of good instruction (Lebow, 1993). See the quran memorization cd in Figure 2.49 and Figure 2.50 in the Appendix. Quran in this application is recited by HozaiFY, a sound which gives the users the ability to read, listen and memorize with some facilities to translate and search the verse as free version. Furthermore, users can run and recite the ayat by clicking it. The following table shows a comparison among the three programs

TABLE 2.3: Comparison among three applications

Technique / Facilities	Nour Elbyan	BianAjmy	Quran memorization cd
Animation	animation was used in Nour Elbyan software	There was no animation in BianAjmy	In this software the programmer did not use the animation
ChildrenRecitation	Nour Elbyan software contains children recitation	Children recitation was not utilized in BianAjmy software	The recitation of children are not in use in the quran memorization cd
Complete Verse	Nour Elbyan did not provide full surah or ayat	There is a complete ayat in BianAjmy software	Quran Memorization cd provide full ayat

Style and colors

The style of the BianAjmy and the Quran memorization cd is in general and they were produced without animations whereas colors were not applicable in the Quran memorization cd and they used pictures in the BianAjmy. Furthermore, the style of the Nour Elbyan was in an animated style but they focused on teaching the Arabic language through Al-Quran. Finally, there was Quran Flash by pictures and audios.

Suggestions

These CDs need to be improved by using animated characters, children's recitation and to find the proper technique to help students to learn and memorize the Holy Quran. Thus, this study will provide a new model which is QM3 to overcome the difficulty of memorizing Al-Quran based on the new technique for the effective model which will be developed.

2.8 Summary

In this chapter, the issues faced by children in memorizing the Quran from the perspective of learning are covered at length. To resolve this issue, there is a pressing need to combine the usage of verbatim and semantic memory in memorization. This is further confirmed by the cognitive theory of multimedia learning that recommends a set of effects or principles to improve learning and memory. Using instructional design, the ideas can be materialized into an actual e-learning application, besides evaluating of group of application in the market.

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