CHAPTER III

METHODOLOGY

3.1 Introduction

The research design consists of the qualitative and quantitative approachesthat are conducted to carry out the investigation. Qualitative approach is conducted in the early phase of the research to study social and cultural phenomenon which is correspond to the common or current manner to learn the quran through e-learning;while the quantitative approach is conducted in the next phase to study the natural phenomena that refers to the mechanism of memory in term of memorization.

In other words, qualitative method is used to collect and analyze the data. The quantitative method is used to support the qualitative data because of the statistical analysis which provides an accurate analysis and prediction. Utilizing both methodologies enhances the reliability of the results and tests. Moreover, quantitative data supports the final conclusion according by evaluating the qualitative data. In addition, observation is applied as one of the elements in the study's instruments. It focuses on the instructor's technique and the reaction of the participants.

According to Faryadi, Q, (2009) qualitative methodology is extremely naturalistic and carried on in real time with the researcher in control. Besides, the study proves that a mixed methodology design gives the researcher better understanding for the research problem. Hence, the investigator of the current study combined both methods of qualitative and quantitative to supplement each other in the research field.

The experiment is conducted with Libyan school's students. However, the holy-Quran is taught in a purely traditional way via an intervention and the setting of face to face learning to 35 students of a Libyan school's students. The content of the course is taken from the holy book of al-Quran syllabus (Faryadi et. al, 2007). The instrument consists of constructed pre-test and post-test and observation of students in classroom. The type of questions is to choose five ayat randomly.

This research applies passive or direct observation in the investigation. In passive observation, the researcher has no effect on the participants. The researcher observes the students inside the class to identify the techniques and the approach used by the instructors of the school in order to provide the proper technique to the participants who can recall and recite the verses of the holy Quran by memorizing, based on the technique of QM3 (Ariffin et al, 2013).

Table 3.1: Present errors of memorizing ayat for 3 participants in pre-test (TM)

No	First Time	Second Time	Final Time	Total Avg = (A+B+C) / 3	Average Error = (Total Avg / Total Number of letters)
1	17	14	13	14.6667	0.13095
2	5	3	4	4	0.0357
3	12	15	17	14.6667	0.13095

Table 3.2: Present errors of memorizing ayat for 3 participants in post-test (QM3)

No	First Time	Second Time	Final Time	Total Avg = (A+B+C) / 3	Average Error = (Total Avg / Total Number of letters)
1	0	1	1	0.6667	0.0041
2	0	0	1	0.3333	0.0021
3	0	18	0	6	0.0375

Table 3.1 and Table 3.2 signify the error or mistakes of the participants. Some students could not memorize the ayat properly so they forgot some letters or spelled them wrongly which can be considered as an error. However, some students also did not succeedin completing the memorization of ayat perfectly on time, which was considered as a mistake.

The total average of letters was calculated via the following formula:

Total Average of Letters = (A + B + C) / 3

Where A= first time, B= second time, C= final time;while the average of errors or mistakes was calculated by the following formula:

Average Error = (Total Average of Letters / Total Number of letters for ayat)

Table 3.3: Thecorrect memorizing of ayat for 3 participants in pre-test (TM)

No	First Time	Second Time	Final Time	Total Avg = (A+B+C) / 3	Memorization Time = (Avg Time (180 s) / Total Avg)
1	95	98	99	97.3333	1.8493
2	107	109	108	108	1.6666
3	100	97	95	97.3333	1.8493

Table 3.4: Correct memorizing of ayat for 3 participants in post-test (QM3)

No	First Time	Second Time	Final Time	Total Avg = (A+B+C) / 3	Memorization Time = (Avg Time (180 s) / Total Avg)
1	160	159	159	159.3333	1.1297
2	151	147	153	150.3333	1.1973
3	160	142	160	154	1.1688

Table 3.3 and Table 3.4 show the memorization time for each letter and the correct memorization of the ayat or letters for each participant. Some students cannot memorize the ayat during the considered time as the same as in the table,so they took more time in memorizing with the traditional approach. On the other hand, other students were successfulin completing the memorization of ayat or letters perfectly on time in QM3; thus it can be concluded that it is time consuming for traditional way and time reducing in QM3. The total average was calculated via the following formula:

Total Average of Letters = (A + B + C) / 3

Where A= first time, B= second time, C= final time;while the average of errors or mistakes was calculated by the following formula:

Memorization Time = (Avg Time (180 s) / Total Average of letters)

Memorization Time = (180 / Total Average of letters)

The researcher carried out anhour period time inside the classroom to observe participants behavior in the class. Findings from the observation and the field notes specified that there was no specific or instant change for the mood inside the classroom with the traditional method of memorizing al-Quran. Also, when participants left the classroom, the observation showed some signs of worry on their faces as some of them looked confused (Faryadi, Q. 2011).

On the other hand, it was noticeable that there were changes in the participant's mood with the QM3 approach; when participants left the classroom, the observation showed some signs of worry on some of the participant's faces because they did not finish memorizing on time or failed to recall the ayat in the proper way.

Ikhwanuddin et al. (2014) stated that this research applied a quantitative method; therefore, in order to have additional and deep information with respect to methods taught at the Libyan school, it is recommended that both qualitative and quantitative approaches be used. Both approaches, if applied, would allow for a more firm statistical test be conducted, which would lead to a more precise, valid and reliable finding.

In other words, the research emulates the one group pretest – posttest experimental design (Kirk, 2009; Dimitrov & Rumrill, Jr., 2003; Shadish et al, 2002), of which the same applicants are studied before (pretest) and after (posttest) a precise intervention is applied (Dunning et al, 2013). The intervention in question here is the proposed approach of improving memory called the Quranic Multimedia Memory Model (QM3).

On the other hand, there are two teaching and learning approaches explained in this chapter. They are the traditional memorization model (TM) and theQuranic multimedia memory model (QM3). The new approach (the proposed model) is built based on a theoretical research. These methods are selected from the prospect of their potential in teaching and learning.

Conducting the experimentation for the research involved the development of an actual e-learning application from the theoretical assertion covered by the proposed m9odel. The application offered two modes of memorization – traditional and the Quranic Multimedia Memory Model (QM3). This allowed the participants to experience memorization from two different approaches, which could accentuate the contrast, should there be any.

For the experimentation, the pretest and posttest experimental design (Broughton et al., 2011) was used. It allowedfor a comparison to be made between the traditional method and the proposed one by analyzing the impact of each process on the performance of memorization. Two measures e\were of importance here. They were the correct recitation from memory and the total duration of memorization.

Performance of memory (Sheng et al., 2015) was evaluated based on how quick it can be performed and how closely it resembled the original artifact from the Quran. Since time was set constant for the experimentation, the rapidity of memorization was derived by the total number of memorized letters within the allocated duration. More letters implied greater propensity of alacrity. Besides that, the exactness of memorization was also crucial, and reflected by the ratio of correct recall to erroneous ones.

3.2 Traditional Memorization Model

The traditional way of memorizing the Quran relied heavily on repetition (Wilis & Gathercole, 2001) whereby the learner viewed and recited the surah to be memorized again and again. The learner initially performed acquisition to read the Quran and then repeated the perusal until the surah was engraved into memory. This approach can be quite effective as proven by history. Over the centuries, many Islamic scholars had dedicated their lives to memorizing the entire Quran that spanned a total of 6666 ayat. Although complete memorization was a feat, many had shown its remarkable feasibility.

Despite the effectiveness of the repetition stratagem, it did have a drawback. The method was quite time consuming. Learners of the Quran invested countless hours everyday to memorize the many surah. This can be attributed to the repetition cycle that was inherent in the traditional memorization repertoire. In other words, something must be repeated again and again for the memory imprint to remain present through time. Furthermore, with repetition, the length of the surah impactedthe memory. Surah with more ayat can leave the learner more susceptible to forgetting (Baddeley et al, 1984).

Another challenge in memorizing the Quran was the degree of discipline demanded. The learner must persist in the effort of repeating the ayat through passive learning (Yunusa et al, 2011). Although this may not be much of an obstacle to more matured students, it was fairly stultifying to younger ones. As a consequence, most younger learners nowadays, especially the ones in primary school were not that motivated to memorize the Quran. It was therefore vital to develop a new model of memorization

that utilized multimedia technology to assist the learners in the endeavor to remember the Quran. The overall sketch provided in Figure 3.1 shows the normal process for memorization using traditional manner, Figure 3.2presents an overview for the inside process (big picture) and a detailed view of the model as in Figure 3.3.According to West (2010), the preferable experimental time for memorization was 3 minutes.Therefore, the proposed method is conducted based on the recommendation.

Figure 3.1: Traditional Memorization Model in overall sketch

Figure 3.2: Overview for the inside process (big picture) for Traditional Memorization Model (TMM), N= Ayah no

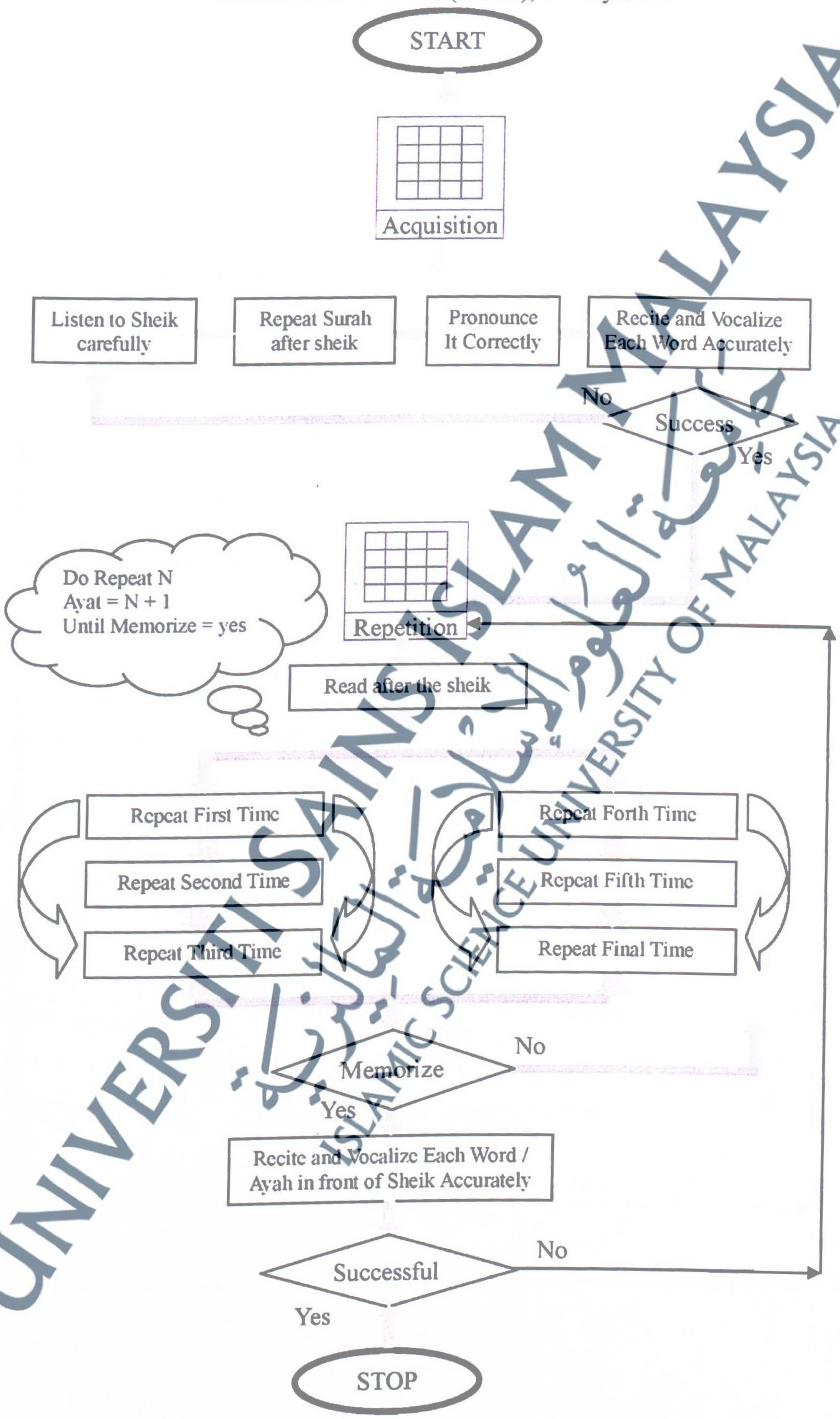
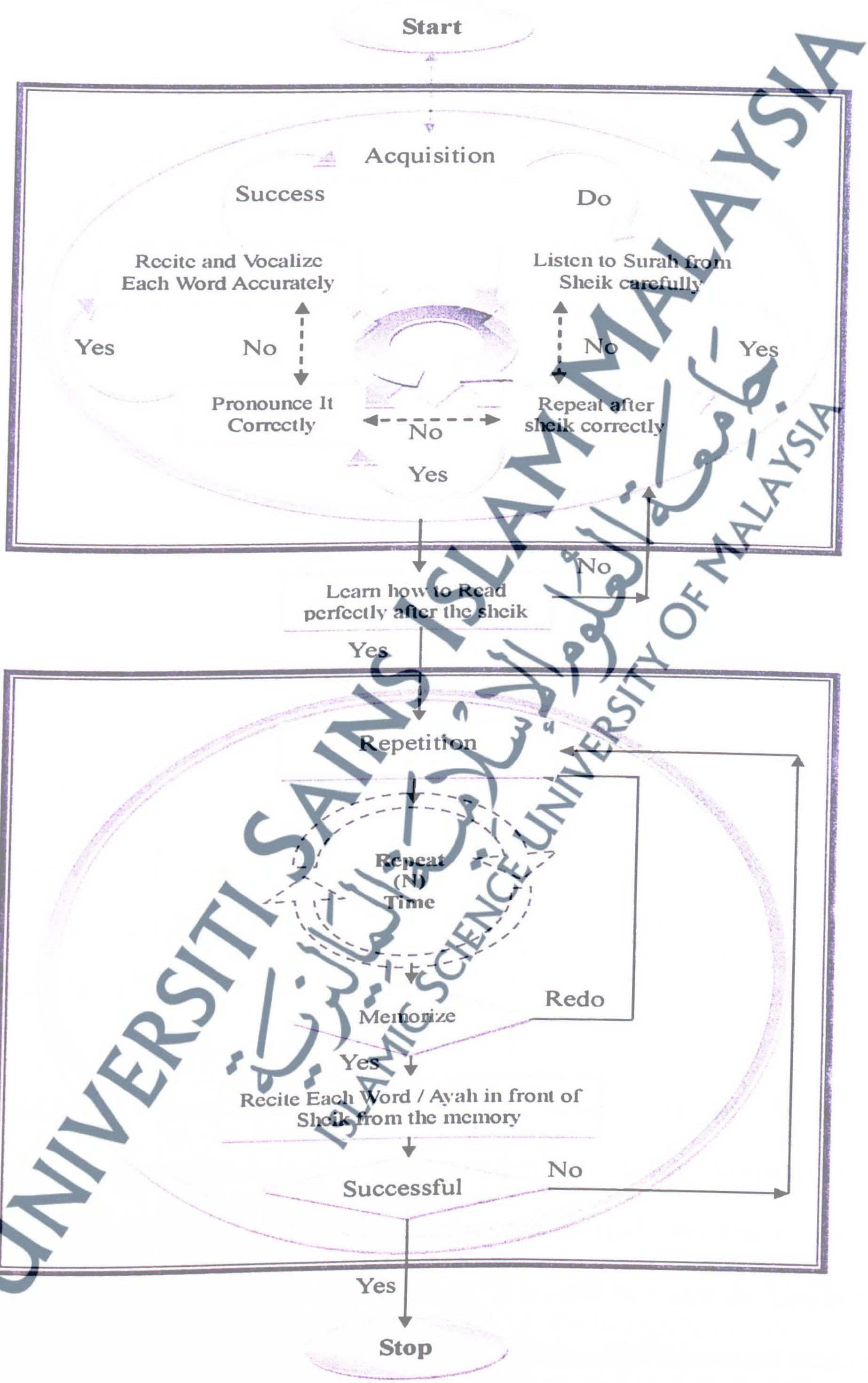


Figure 3.3: Detailed view Process of Traditional Memorization Model (TMM), N= Ayah no



3.3 Quranic Multimedia Memory Model

The Quranic Multimedia Memory Model (QM3) is a model that enables the enhancement of memorizing the Quran. It is derived from two major components – Cognitive Theory of Multimedia Learning (Mayer, 2014; Mayer & Moreno, 2003) or simply known as CTML, and models of memory (Yeh, et al., 2014; Repovs & Baddeley, 2006) or abbreviated as MM. CTML outlines the general cognitive processes that are required for the improvement to take place while MM provides a more thorough elucidation of how it can be implemented. However, the overall sketch, big pictures and detailed view of the model are provided in Figure 3.4, 3.5, 3.6 in the following sections.

The model consists of four main phases. Each phase contributes to the entire repertoire of memorization and cannot work in isolation. In this respect, the phases are closely connected to one another. They have a synergistic relationship that ensures the effectiveness and efficiency of memorization as a whole. It is therefore imperative to employ all the phases properly, to succeed in the application of the model. The general purpose of Quranic Multimedia Memory Model explained in four phases.

1. Acquisition (Bohn-Gettler & Panayiota Kendeou, 2014)

In the acquisition phase, the learner peruses over the surah to be memorized without any intention of placing it in memory. This is a critical stage whereby the correctness of pronunciation is emphasized. If a particular surah is not read accurately, then the memorization would be flawed as well. Here, it is vital to notice the possible variation of reading the Quran per se without any consideration of its memorization.

2. Abstraction (Son, Smith & Goldstone, 2008).

The effort of memorizing the entire surah can be quite daunting. Abstraction placates this by offering the learner with a simplified version of the surah that must first be committed to memory. This prepares the learner with the right state of mind for verbatim memorization.

3. Absorption (Ding, 2007)

During absorption, the actual process of memorization transpires. Here, the learner conducts a series of cueing, decomposition, repetition and cascading to make a greater imprint to memory. This allows the formation of memory to be done incrementally for a sustainable result.

4. Assertion (Nagy, D. & Szamosközi, 2014)

After memorizing the surah, it is vital for the learner to assert the recently constructed memory through sufficient practice and monitoring. In this phase, the learner actively recalls the surah in sequence and monitors the accuracy.

Observe the cycle between absorption and assertion. This implies that both might work in tandem when memorization occurs. The learner would shift between absorbing the content and asserting recall to construct a more lasting impression of verbatim memory, especially when assertion signals a rather significant deficit in memorization.

Figure 3.4: Quranic Multimedia Memory Model (QM3) In General

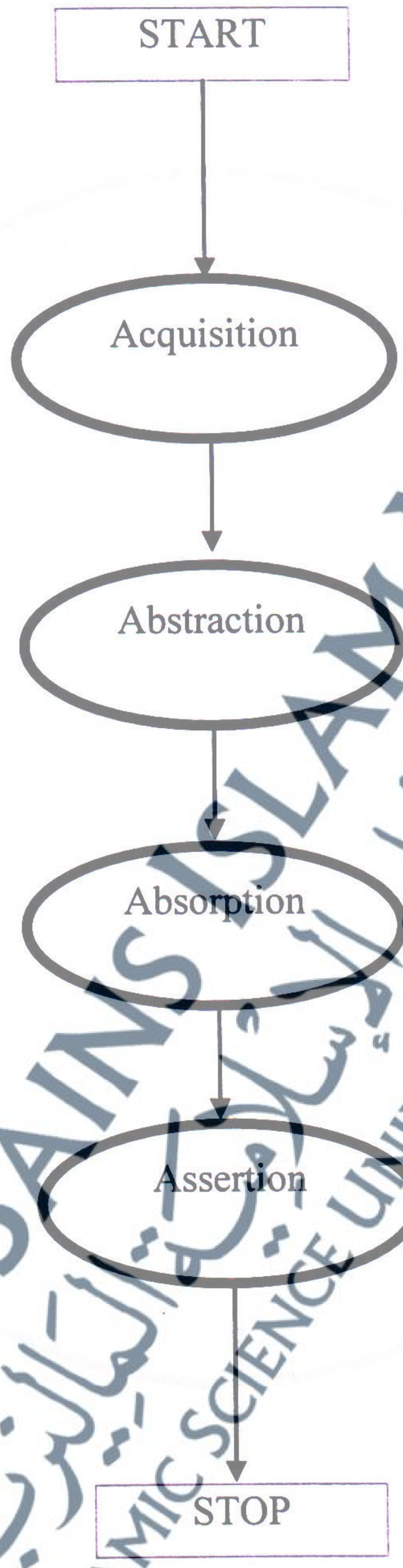


Figure 3.5: Process of Quranic Multimedia Memory Model (QM3)

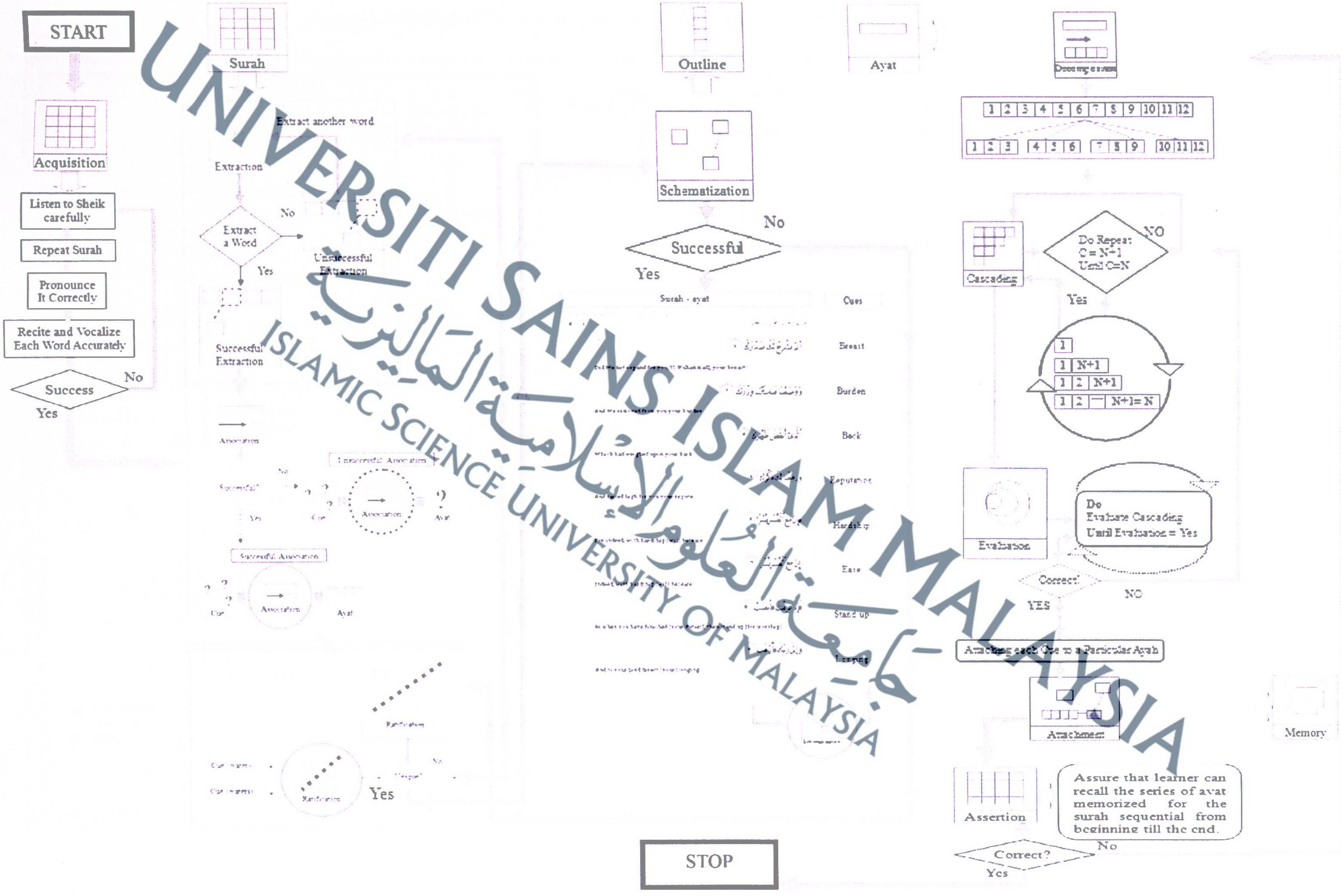
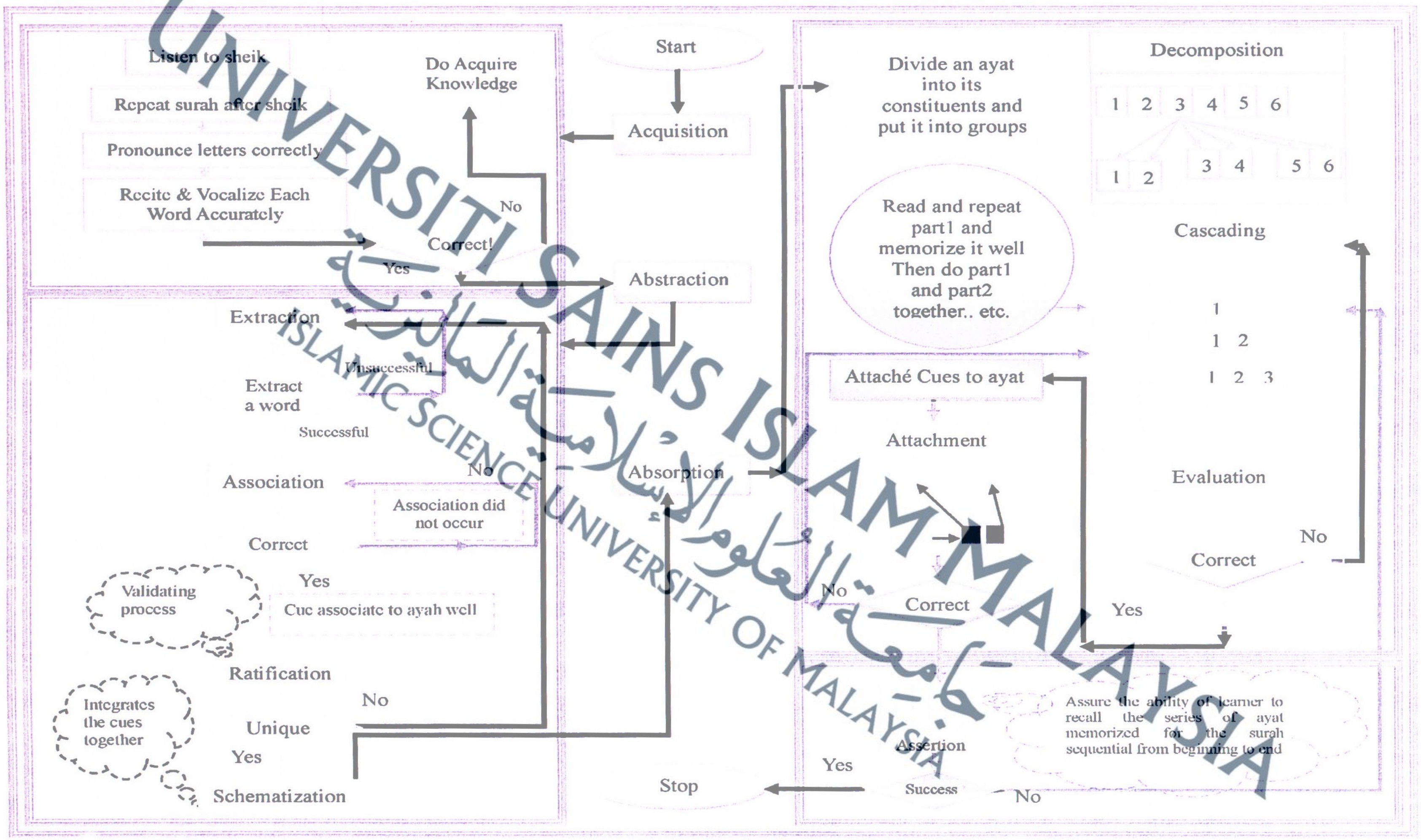


Figure3.6: Detailed Process of Quranic Multimedia Memory Model (QM3)



3.3.1 Acquisition in QM3

Acquisition is concerned mainly on the correctness in reciting the Quran (Hassan & Zailaini, 2013a). Each word in the Quran must be vocalized in the right manner to ensure that the actual intended meaning is enforced. The study of phonetics in reading the Quran is known as tajweed. It includes the definition of proper pronunciation for all the Arabic alphabets in terms of the sound, length and emphasis. Correctness is essential to maintain the purity of Quran, which does not change with time or situation.

The implementation of tajweed (Hassan & Zailaini, 2013b) is truly important in the reading of the Quran. When a learner reads the Quran, tajweed must be done and monitored with care. There are a total of 28 Arabic letters contained within the Quran. Each letter has numerous variations and can be pronounced in a variety of ways depending on the marking. For instance, for the first letter, which is aleef, there are three basic ways of pronunciation (Figure 3.7).

Figure 3.7: Basic Variation in Pronunciation

بـ	بـ	بـ	أ	أ	إ	أ
بـ	ثـ	ثـ	ثـ	ثـ	ثـ	ثـ
حـ	جـ	جـ	جـ	جـ	ثـ	ثـ
خـ	خـ	خـ	خـ	خـ	خـ	خـ
ذ	ذ	ذ	ذ	ذ	ذ	ذ
ر	ز	ز	ز	ر	ز	ز
سْ	سْ	سْ	سْ	سْ	سْ	سْ
صْ	صْ	صْ	صْ	صْ	صْ	صْ
طْ	طْ	طْ	طْ	طْ	طْ	طْ
عـ	عـ	عـ	عـ	عـ	عـ	عـ
غـ	غـ	غـ	غـ	غـ	غـ	غـ
فـ	فـ	فـ	فـ	فـ	فـ	فـ
كـ	كـ	كـ	كـ	كـ	كـ	كـ
مـ	مـ	مـ	مـ	مـ	مـ	مـ
نـ	نـ	نـ	نـ	نـ	نـ	نـ
وـ	وـ	وـ	وـ	وـ	وـ	وـ

Individual letters has different pronunciation. However, there are certain letters that may not appear to be similar from the symbolic perspective but their pronunciation bears a noticeable likeliness. Here, the nuances of pronunciation are critical. To illustrate this notion, consider the alphabet z whose pronunciation can be represented by three kinds of letters in Arabic. They are dal-dzal, ro-dzai, to-dzo. The learner

must be able to grasp these subtle differences in pronunciation (Navehebrahim, 2012) to read effectively. Another consideration in reading is the length of pronunciation (Akyol, 2013) allocated for the alphabets within the Quran. The duration of pronunciation determines the span of time demanded by the letters. From the simplistic view, there are three different lengths. The pronunciation can either be short, medium or long. It must be highlighted however, that the actual amount of time assigned to the categorical duration is not fixed. It depends on the tempo decided by the reader.

Tempo is also essential in speech (Weirich & Simpson, 2014). To demonstrate the variability of pronunciation based on tempo (Table 3.5), assume that the reader is choosing a slow tempo, of which each unit of time is denoted by a second. This implies that the pronunciation can be 1 second (short), 2 seconds (medium) or 3 seconds (long). On the other hand, if another tempo is chosen, say a fast tempo, where each unit is signified by half a second, then the variation would be ½ second (short), 1 second (medium) and 1.5 second.

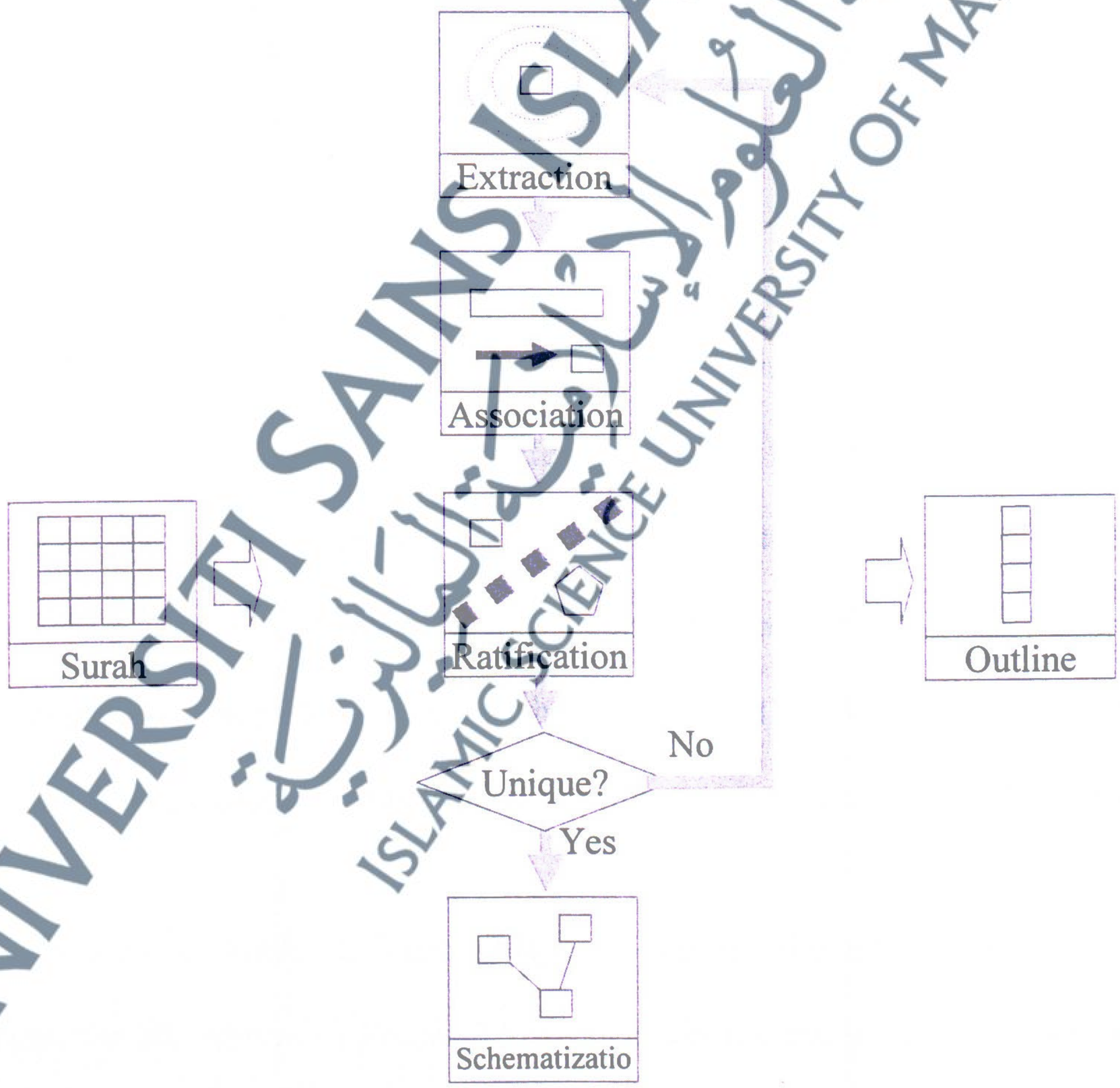
Table 3.5: Possible Relationship between Tempo and Pronunciation Variability

Tempo	Unit	Short	Medium	Long
Slow	1 second	1 second	2 seconds	3 seconds
Fast	0.5 second	0.5 second	1 second	1.5 seconds

3.3.2 Abstraction in QM3

Based on the principle of learning from simple to complex or incremental learning (Oppenheim, Dell & Schwartz, 2010), any form of memorization should progress gradually in terms of complexity. This is the motivation that drives the employment of abstraction in the model. The learner is given a simple version of the surah to be memorized before a complete version is presented. Working in this manner allows the learner to pace through the memorization stage in a more graceful manner. Generally, abstraction demands the four steps, as demonstrated in (Figure 3.8).

Figure 3.8: Four Phases in Abstraction for QM3



3.3.2.1 Extraction in Abstraction

Memorizing an entire ayat can be quite demanding, intellectually. It requires a high degree of concentration. Therefore, it is advisable to proceed gradually. Now, if the ayat is perceived as a collection of elements, then extraction or cueing (Hund & Gill, 2014) is the attempt of selecting just a single element to represent the entire ayat. This element is called the anchoring element or cue for the ayat. As such, although a complete ayat might be long, choosing a single element can guarantee a short description for the ayat.

$A \rightarrow W_1 \ldots W_N$ (this is to show the Ayat **A** and how many word it contains)

$W_1 \ldots W_N \rightarrow W_K$ (this is to show the words and how many anchoring elements where chosen from them)

$W_K = C$

Where, $\mathbf{W_K}$ is the anchoring element or cue **C** of the ayat **A**. In reality, assigning the right cue (Arsalidou, Pascual-Leone & Johnson, 2010) for a particular ayat is rather critical for extraction. The right cue would necessitate a marginal effort for memorization. On the other hand, the wrong one would either fail to help in memorization or completely challenge the capacity of the mind. Thus, to ensure the most appropriate extraction, this is performed by the supervisor and not the learner.

The type of cue (Gade & Koch, 2014) determines the effectiveness of usage. Consider the illustration in Figure 3.9 to ascertain the importance of selecting the right cue for extraction. The ayat is taken from the 3rd ayat of surah Qamar. For

extraction to occur, a single word must be extracted from the ayat. Observe that in the ayat there are a total of **13** words. Here, choosing the word 'appointed' may not be recommended because it is an adjective. Furthermore, it does not evoke any strong emotions.

On the other hand, making the word 'lusts' as the axial is more appropriate. This might be due to the fact that 'lusts' is a concept (Khokhlova, 2014) while 'appointed' is an attribute or characteristic of a concept. A rather salient principle to highlight here is that a learner has a higher tendency to remember a concept than an attribute. The concept offers a comparatively stronger form of concretization to memory. On the other hand, an attribute revolves around a concept. As such, it serves better as an auxiliary element.

Figure 3.9: Cue Extraction for surah (54), verse 3.

54:3 They reject (the warning) and follow their (own) lusts
but every matter has its appointed time

Inferior selection of cue:
Appointed

Superior cue selection:
Lust

3.3.2.2 Associationin Abstraction

Once the cue is selected, the next step is to associate the cue to the ayat (Potheegadoo et al., 2014). This is not an automatic procedure. Learner must be explicitly requested to relate the cue to the ayat. If not, there is a possibility that the association will not occur. Practically speaking, this implies that for every time the cue **C** is activated, the learner must be able to retrieve an impression of the entire ayat **A**, which comprises of words $\mathbf{W_1 ... W_N}$.

$W_1 ... W_N \rightarrow W_K = C$ (this is to show how many cues **C** where chosen from the entire Ayat)

Connecting the cue with the words is a necessary task. When a learner is not explicitly encouraged to remember a particular cue, there is a tendency of complacency to occur. Thus, deliberate instruction (Khodabandelou & Samah, 2012) with regard to acknowledging the cue as being related to the ayat must be instigated (Brevik, 2014). An important point to note here is the function of the cue. Here, the learner does not memorize the ayat. Instead, only the association between the cue and the ayat is given emphasis.

Having a cue relieves the mind from the actual burden of memorization (Sabri et al., 2014). However, it is not final. In other words, a cue cannot stand on its own. It must be actively attached to the ayat at hand. If association is successfully performed, the learner would experience a compelling stimulation to recall the entire ayat every time the cue is presented (Figure 3.10). This acts as an impetus in motivating natural

recall. On the other hand, if unsuccessful association transpires, then the cue will not assist recall in the future (Figure 3.11).

Figure 3.10: Successful Association between Cue and other words in one Ayat

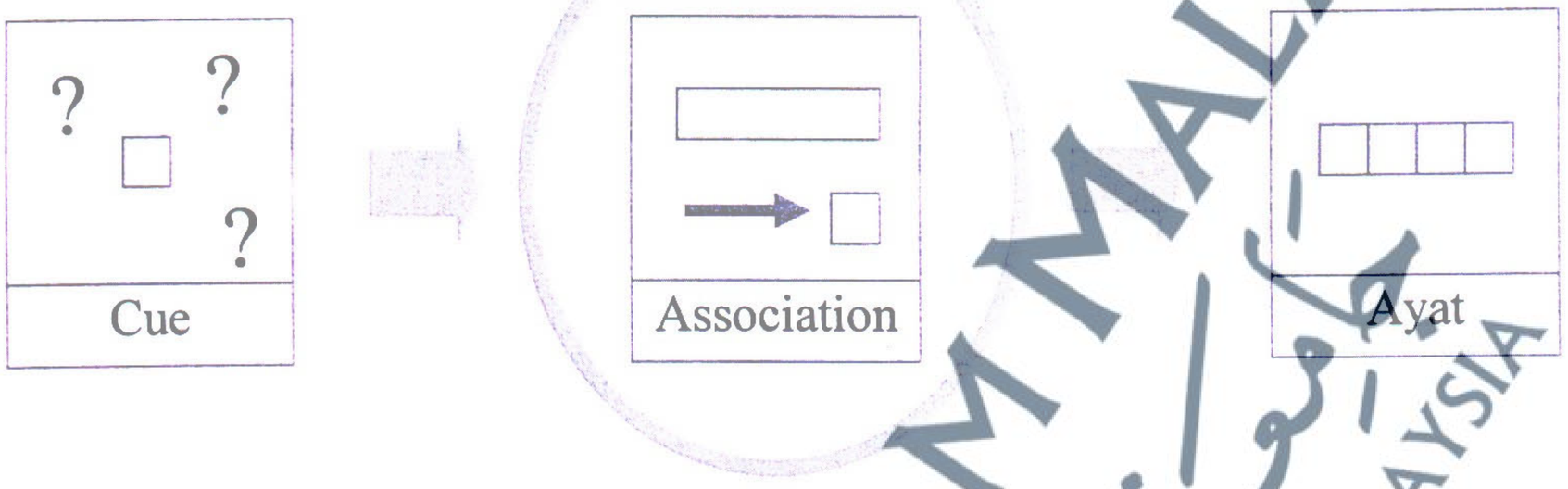
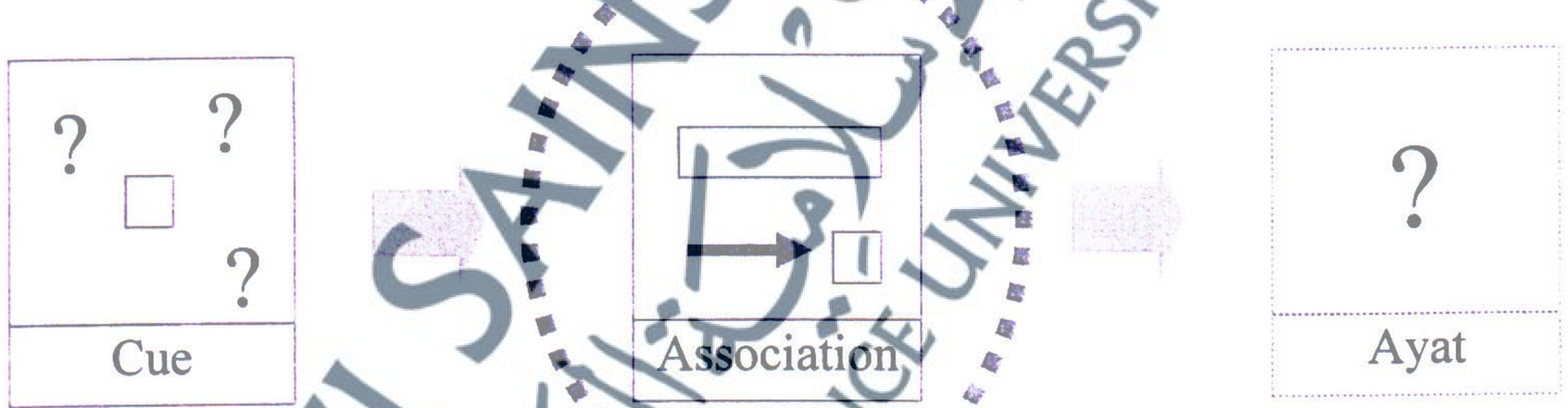


Figure 3.11: Unsuccessful Association between Cue and other words in one Ayat



3.3.2.3 Ratificationin Abstraction

For abstraction to be effective, the cues or anchoring elements must be unique (Mok et al., 2009) within the surah. Ratification is the process of validating this uniqueness. In the example below (Figure 3.12, 3.13) two ayat 54:11 and 54:12 are taken from Surah Qamar. For the sake of argument, assume that the cue for the first ayat is water while for the second one is waters. This implies that the cues are no longer unique because they are quite similar with one another.

Figure 3.12: Illustration of Ratification

فَفَتَحْنَا أَبْوَابَ السَّمَاءِ بِمَاءٍ مُّنْهَمِرٍ (54:11)

Basit - Hussari - Minshawi

54:11: ﴿So, we opened the gates of heaven, with water pouring forth﴾.

Cue (water)

(Al-Quran. Surat Al-Qamar54:11)

54:12: ﴿And we caused the earth to gush forth with springs, so the **waters** met (and rose) to the extent decreed﴾.

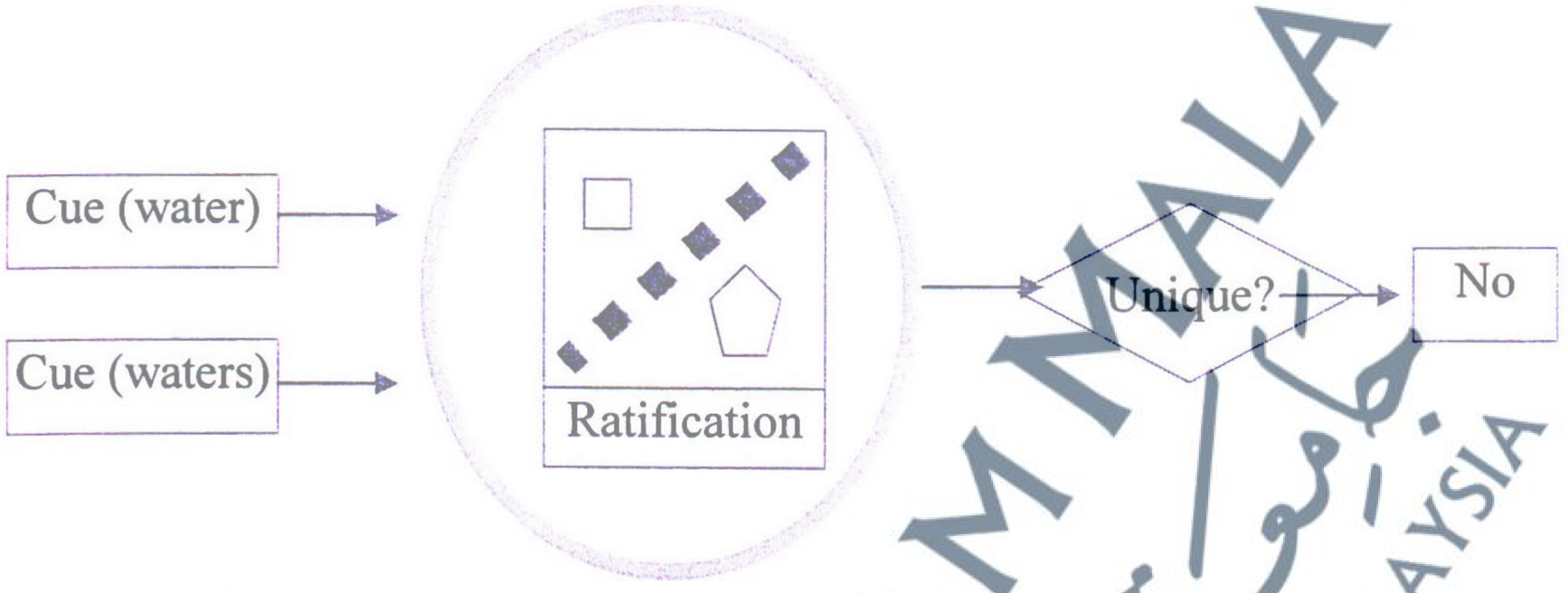
Cue (waters)

(Al-Quran. Surat Al-Qamar 54:12)

Ratification verifies the selection of cues (Von Helversen et al., 2013) to ensure that they are always unique when compared with one another. If any of the anchors are similar, a new anchor must be searched upon. Selecting the new cue or anchor is left to the discretion of the learner. As such, to amend the mistake shown above, either

the former or the latter cue can be changed;supposed that the second cue is changed from waters to earth. When this happens, uniqueness is retained and ratification becomes a success.

Figure 3.13: Illustration of Ratification



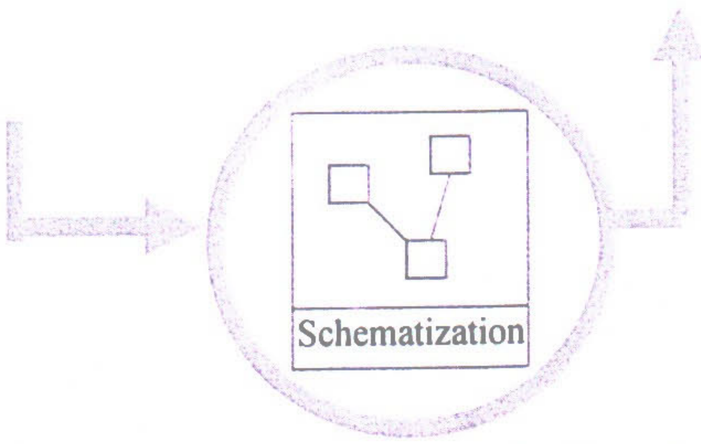
Ratification is vital in this model because it prevents memory interference from occurring. When two items of a similar nature or appearance are memorized together, they may interfere with recall. Confusion might transpire when the retrieval of the intended item can cue the activation of similar items in memory. With ratification, this undesirable situation can be evaded altogether.

3.3.2.4 Schematizationin Abstraction.

Schematization (Zhuge & Sun, 2010) integrates the cues together and can be coupled with visualization (Patterson et al., 2014). Once the cues or anchors are selected and ratified, they must be memorized together. Consider Surah Asy Syarh that consists of 8 ayat. After each cue is chosen for each of the ayat, a total of 8 cues will be derived. These cues act as the schema of the ayat (Figure 3.14). It is rather apparent that the combination of cues to be memorized is significantly less than the actual ayat.

Figure 3.14: Illustration of Schematization. Source from (http://legacy.quran.com/94)

Surah - ayat	Cues
بسم الله الرحمن الرحيم	
ألَمْ نَشْرَحْ لَكَ صَدْرَكَ ١	Breast
Did We not expand for you, [O Muhammad], your breast?	
وَوَضَعْنَا عَنكَ وِزْرَكَ ٢	Burden
And We removed from you your burden	
ٱلَّذِىٓ أَنقَضَ ظَهْرَكَ ٣	Back
Which had weighed upon your back	
وَرَفَعْنَا لَكَ ذِكْرَكَ ٤	Reputation
And raised high for you your repute.	
فَإِنَّ مَعَ ٱلْعُسْرِ يُسْرًا ٥	Hardship
For indeed, with hardship [will be] ease.	
إِنَّ مَعَ ٱلْعُسْرِ يُسْرًا ٦	Ease
Indeed, with hardship [will be] ease.	
فَإِذَا فَرَغْتَ فَٱنصَبْ ٧	Stand up
So when you have finished [your duties], then stand up [for worship].	
وَإِلَىٰ رَبِّكَ فَٱرْغَب ٨	Longing
And to your Lord direct [your] longing.	



(Al-Quran. Surat Ash-Sharh 94)

3.3.3 Absorption in QM3

Having the schema of the surah in mind, the learner is now capable of sustaining a higher motivation of committing the entire ayat into memory. The perspective of this model is what absorption (Kitagaki, 2013) truly entails. It involves the actual memorization of the surah by employing four main components. They are decomposition, cascading, evaluation and attachment (Figure 3.15). The general view for the abstraction and absorption phases are as follows in (Figure 3.16).

Figure 3.15: Four Phases inAbsorption for QM3

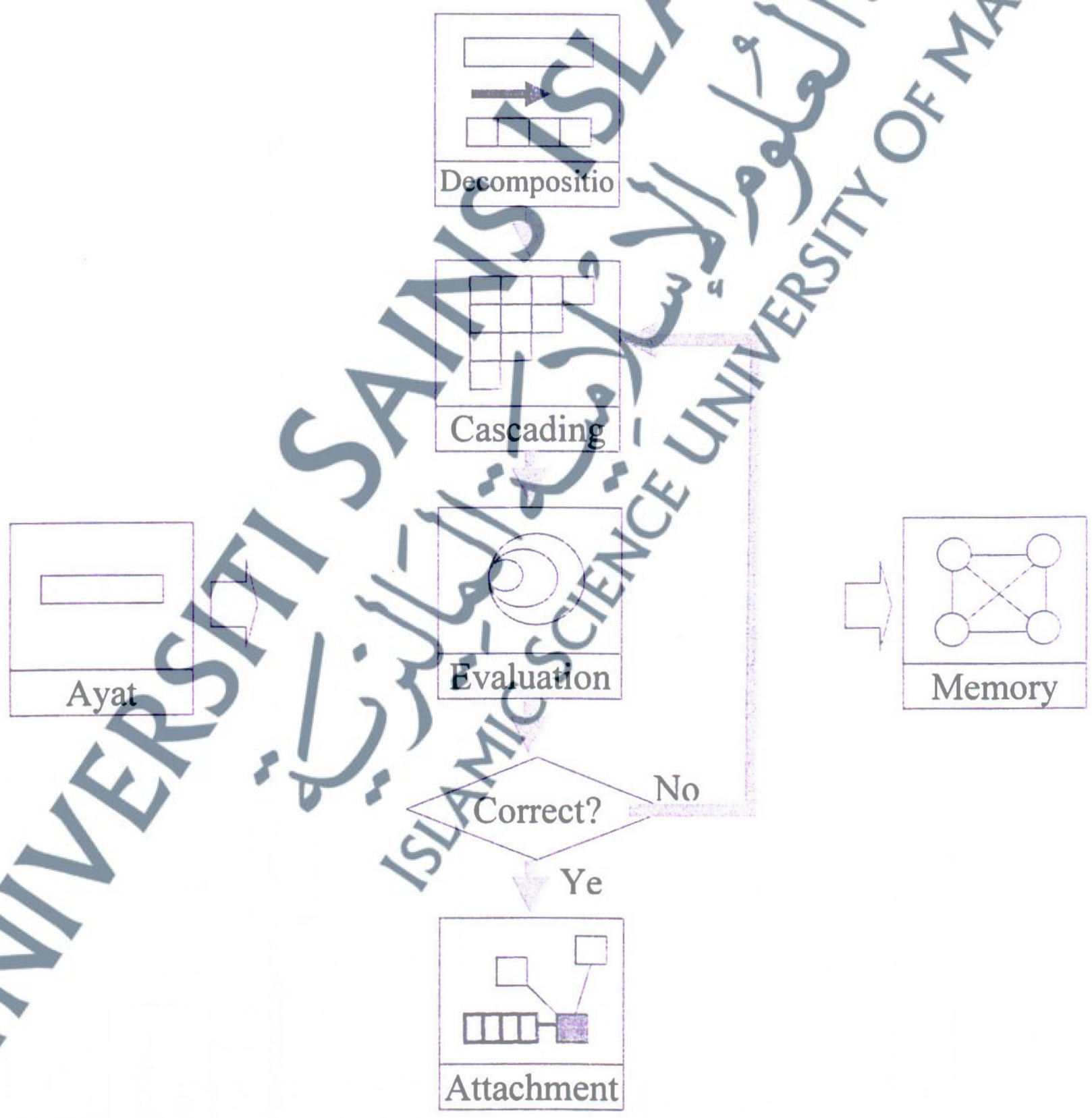
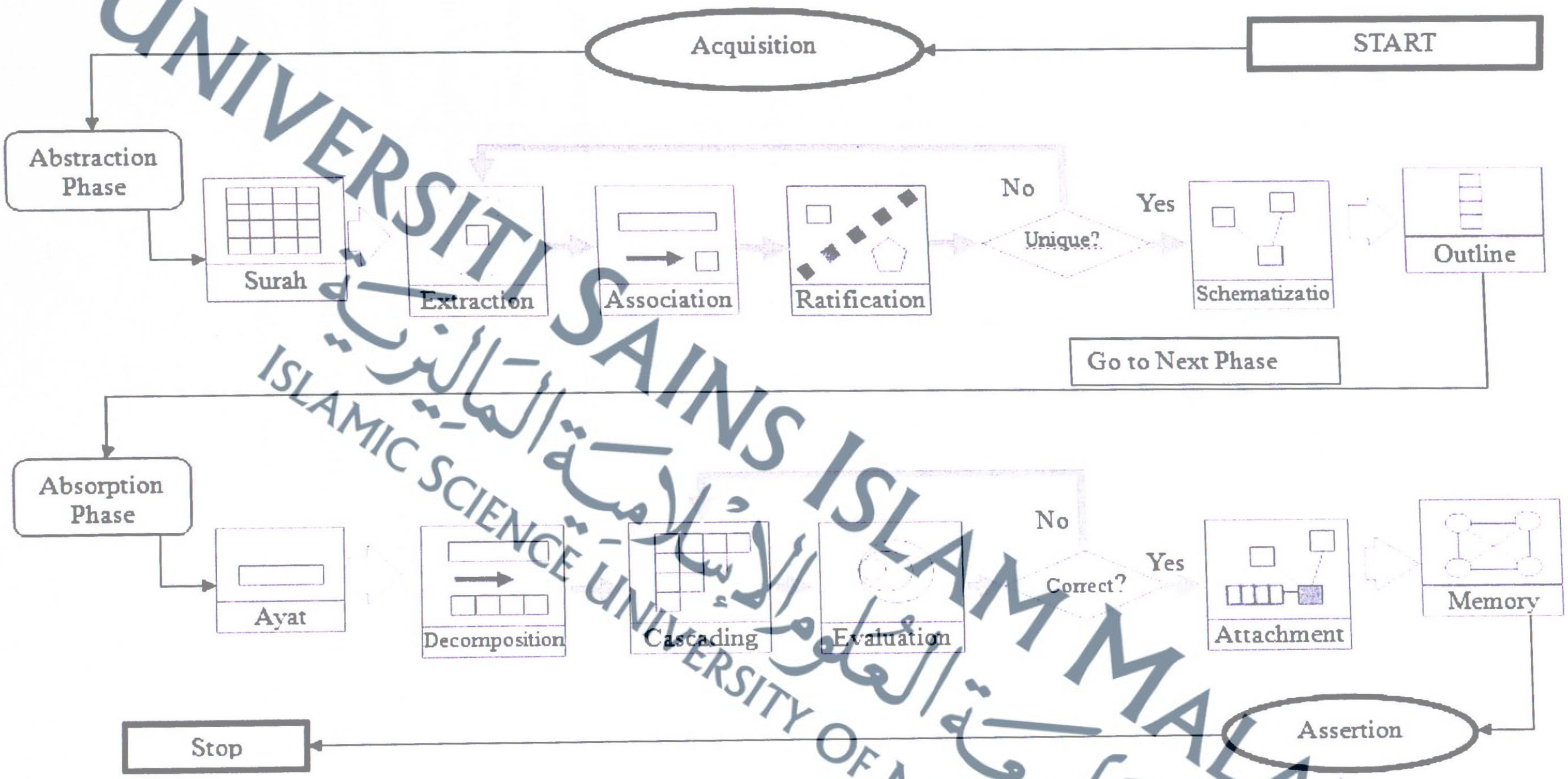


Figure 3.16: Abstraction and Absorption in Quranic Multimedia Memory Model (QM3)



3.3.3.1 Decomposition in Absorption

Managing the portion of elements to be memorized within a particular duration is an important aspect of verbatim memory. Using the rule guided behavior (Amso et al., 2014); memorization task can be partitioned accordingly. A high number of elements can cause strenuous load to memory. As such, it is commendable to have a rule that segments an ayat into its constituents. For the sake of simplicity, assume that a learner needs to memorize an ayat that consists of 12 elements as in (Figure 3.16) in the next section. This can appear as a feat to some people. It is rather difficult to gain proper focus when memory is laden with a demand exceeding the working memory.

W_K , W_M is the anchoring element or cue **C** of the ayat **A** whereas **N** the words no

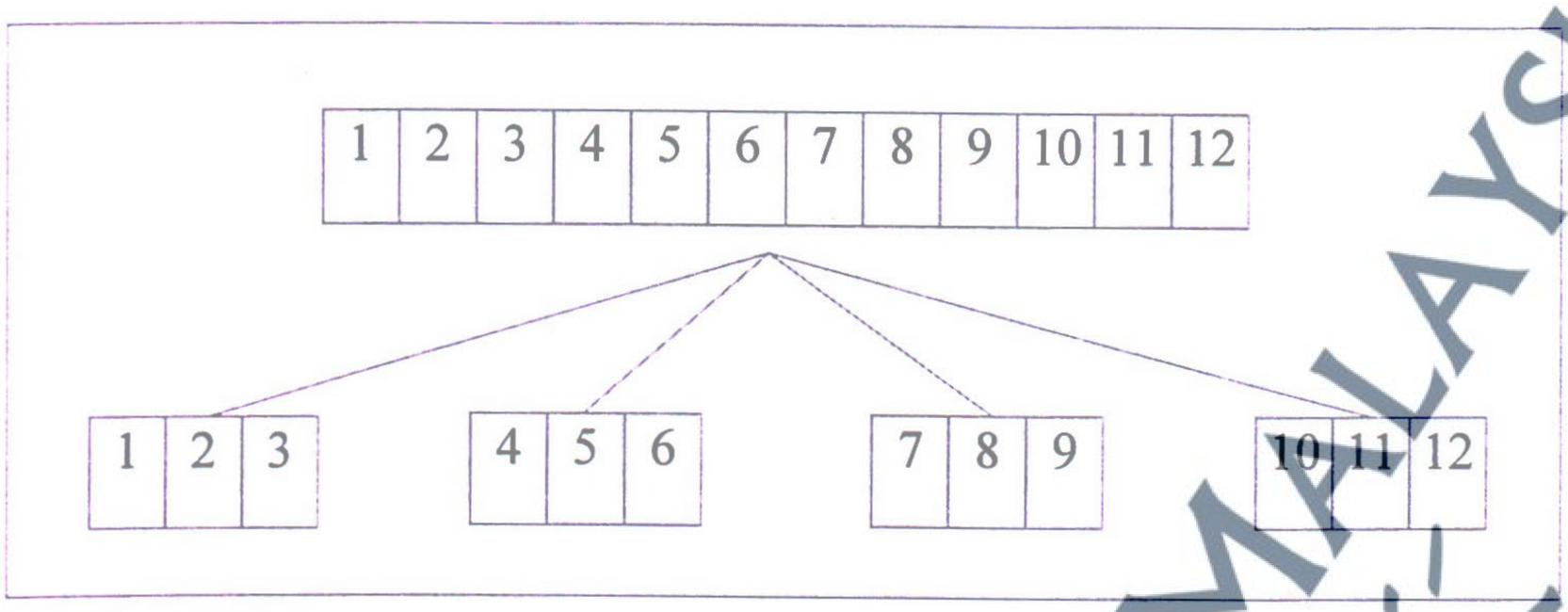
$A = W_{1...} W_N$

$A = W_1... W_K W_{K+1}... W_M W_{M+1}... W_N$ $\quad 1 < K < M < N$

$A = W_1... W_K || W_{K+1}... W_M || W_{M+1}... W_N$ $\quad ||$ = partition

In the aforementioned case, it is advisable to partition the elements into a set of manageable groups called chunks. Although this process is popularly referred to as chunking, the concept of decomposition (Mathy, F. & Feldman, 2012) conveys a more explanatory implication. It is defined as the act of decomposing an ayat to offer a greater sense of concentration to the learner. For instance, the **12** elements can be divided into groups of **3** whereby the attention is fixed at one set at a time.

Figure 3.17: Illustration of Decomposition



The manner of which decomposition is deployed can vary in term of how many items are included per partition. For beginners, it is recommended that the partition is kept at its smallest size, preferably one item per partition. This can make the process of memorization slower. However, it is the least challenging. For average learners, three items per partition is reasonably acceptable. It is crucial to enforce a viable size to ensure that memorization stress is maintained at its minimum.

The size of the partition or decomposition will have a direct effect on cascading. Smaller decomposition will result to a longer period of cascading and vice versa. However, smaller decomposition can also be beneficial because it implies a lower cognitive load. As such, there must be a balance between decomposition size, period of cascading and cognitive load of memory. An optimal balance maximizes a factor without sacrificing the other.

3.3.3.2 Cascading in Absorption

If decomposition works with the amount of information to be memorized within a particular session, then cascading (Fusi, Drew & Abbott, 2005) is mainly concerned with the extent of repetition that should be implemented every time an entirely new portion of element is imprinted into memory. Cascading creates a link between the memorization of new information and the old ones by iterating the cycle of encoding and recall. With each additional encoding, recall is performed to refresh the previously encoded information.

In the notation given below, the ayat **A** is made of a series of words $W_1 \ldots W_N$. In the first session, the learner memorizes the first word W_1. For the second session, word W_2 is memorized and then, W_1 is recalled along with W_2. This ensures that a stronger memory is formed between W_1 and W_2. Not just that, it would also consolidate the link that exists between the previously encoded information (W_1) with the newly encoded one (W_2).

$A = W_1 \ldots W_N$ Ayat A has Series of words W_1 till W_N

$A = W_1$

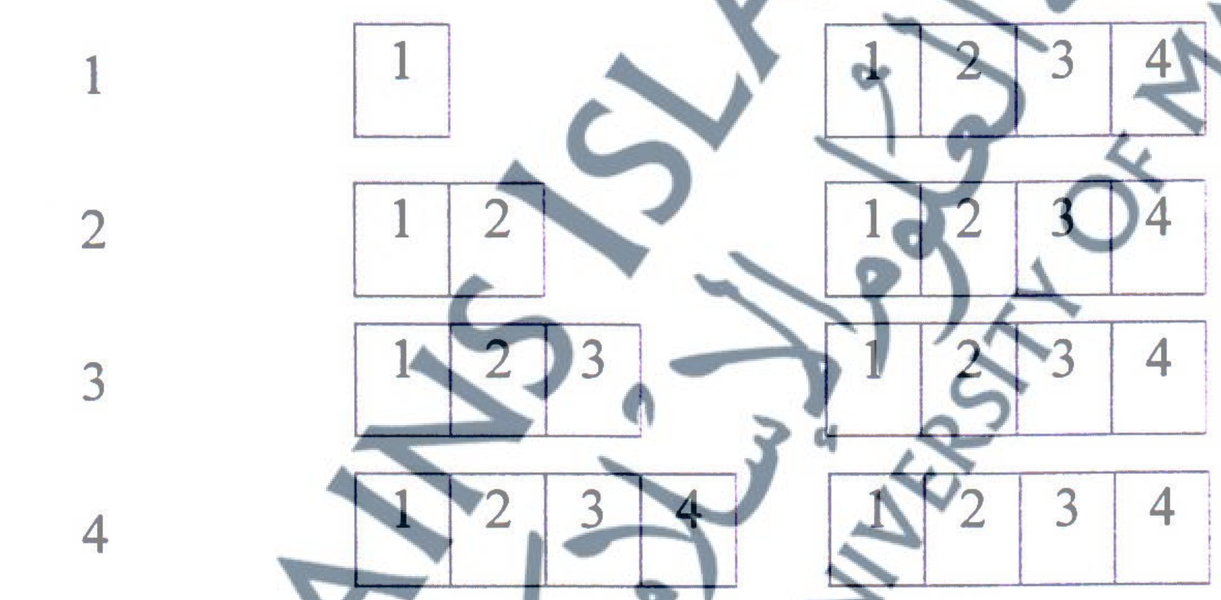
$A = W_1\ W_2$

...

$A = W_1\ W_2 \ldots W_N$

To further illustrate the notion of cascading, consider the comparative scenario of memorizing four chunks of information with and without cascading (Figure 3.18). Practically speaking, the portion of information that the learner focuses on will increase gradually with cascading. Notice that to memorize all the four chunks, the learner will need four separate sessions. On the other hand, memorizing them without cascading implies that all the four parts will be memorized in the first session and repeated.

Figure 3.18: Cascading vs. Non-Cascading



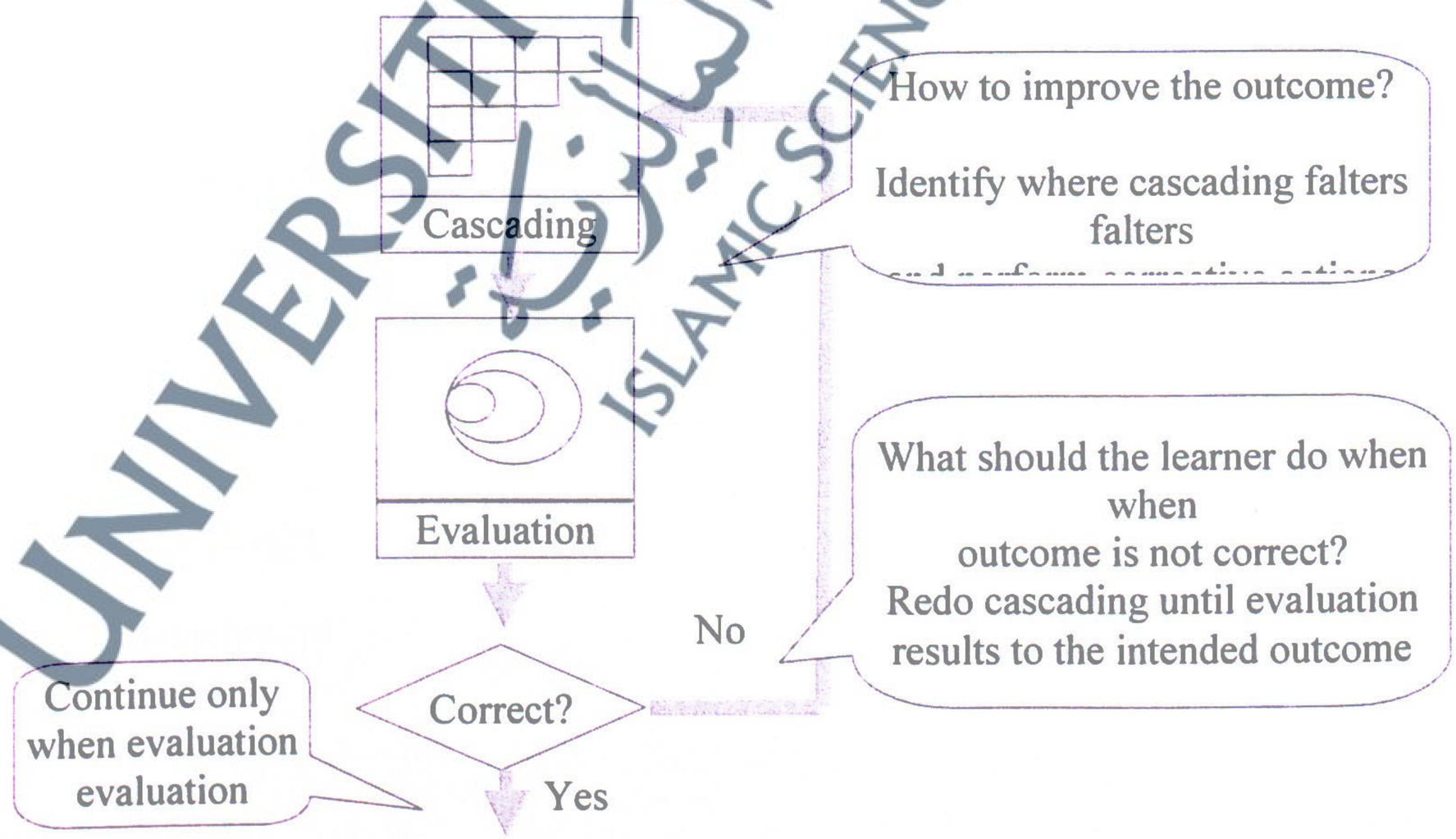
Segmenting the memorization effort with cascading allows the cognitive load of the task to be built in stages. Initially, the load is minute. As time progresses, it becomes more demanding. It is commendable to organize the load in this manner. The learner is given the chance to manage the difficulty of the task step by step. On the contrary, non-cascading forces the learner to consume the entire task in its entirety. This can be quite overwhelming,and memory might become strained in the end.

3.3.3.3 Evaluation in Absorption

The learner is encouraged to anticipate and evaluate the advancement of memorization in every step of the way. This is a form of metacognition (Rummel & Meiser, 2013) from the aspect of memory. After every memorization, it is important to look back and assess the correctness of the elements committed to memory. This is due to the fact that progress can falter without monitoring. When the learner does not actively check the outcome, it would be easy to assume that everything is working as planned, even when it is not.

Evaluation functions closely with cascading. If the outcome is not correct and memorization does not perform as expected, the part where cascading has failed must be identified and improved. This is the implication of the cycle shown below (Figure 3.19). Cascading is repeated until the stipulated memorization goal is fully reflected by evaluation. Although the cycle seems impractical at a first glance, it is critical in the long run. It portrays the importance of master learning.

Figure 3.19: Evaluation – Cascading Cycle

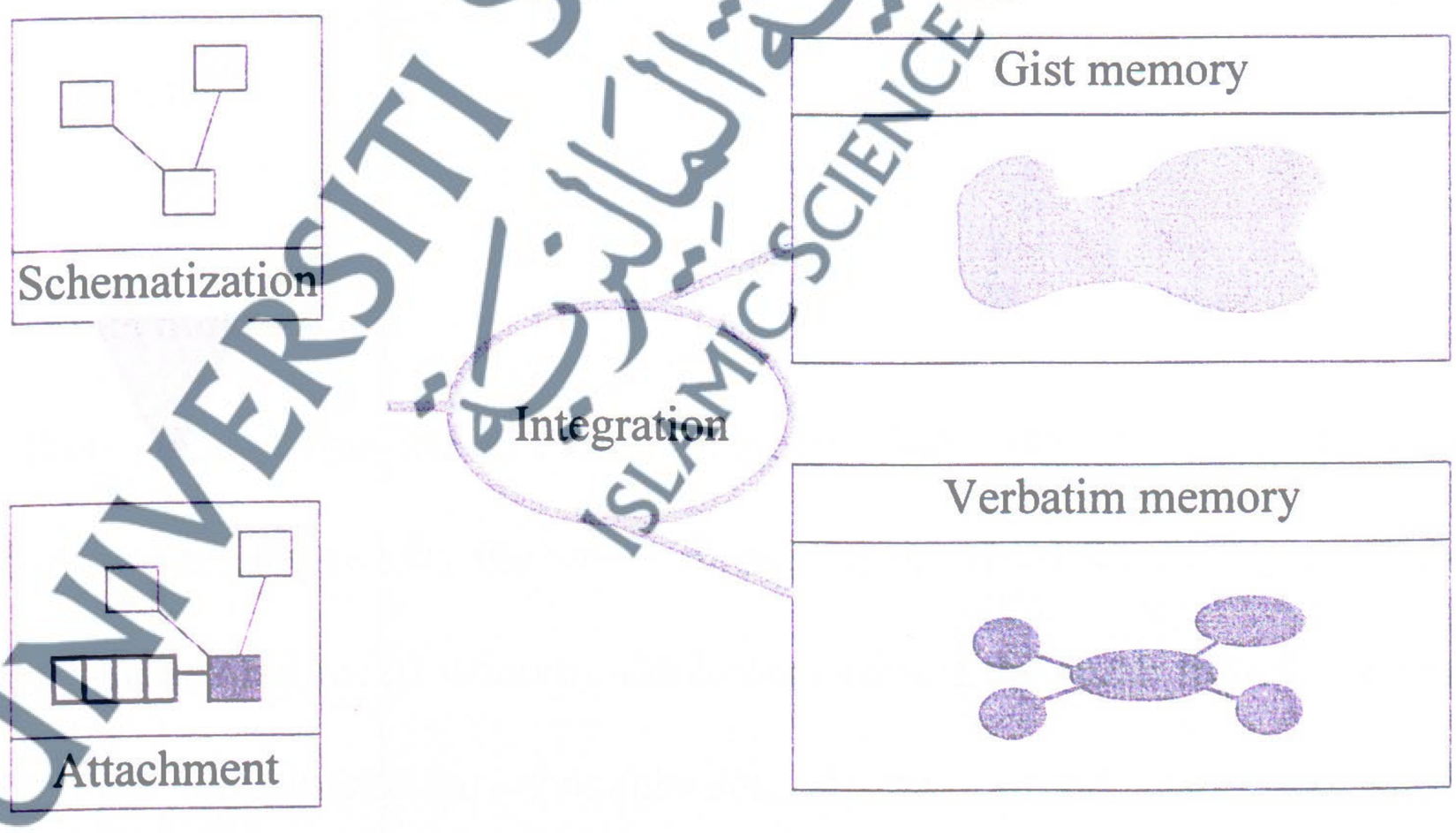


Evaluation compels the student to take charge of the learning process by being aware of what is working and what is not. This can improve self-efficacy (Kingston & Lyddy, 2013; Yailagh et al., 2013). Students who are able to ascertain the obstacle that are preventing them from reaching their goal will become more proactive and confident in dealing with future challenges. As such, by engaging in evaluation consistently, the learner is trained to play an active role in memorization.

3.3.3.4 Attachment in Absorption

After being successful in memorizing a certain ayat, the next step that the learner must take is to attach the ayat to a cue and consequently to a schema itself (Van Kesteren et al., 2012). The process of attachment is essentially connected to schematization that is established in the abstraction phase. While schematization involves the construction of the schema by unifying a set of cues within the surah, attachment deals with the application of the schema in the effort of improving memory.

Figure 3.20: Attachment and Schematization



By attaching the memorized ayat to the cue within the schema, the learner fortifies the possibility of effective recall. This comes from the fact that doing so encourages the learner to cogitate using two different horizons of memory, called the gist and verbatim (Brainerd & Reyna, 2004) in a more collaborative fashion,thus, enabling a greater sense of control when it comes to traversing or searching a particular ayat in mind.

The idea that propels the integration of both memory levels is inspired by the realization that each possesses its own strength and weakness. Verbatim memory is specific and detailed. However, its deterioration occurs quite rapidly after memorization that may result to false memory (Reyna, 2000). On the other hand, gist memory (Bouwmeester & Verkoeijen, 2011) provides higher stability through time. Unfortunately, it lacks the exactness required. It is reasoned that by hydridizing both levels of memory, the strengths can be combined and the weaknesses eliminated.

Figure 3.21: Integrated Memory through Schematization and Attachment

	Verbatim Memory	**Gist Memory**	**Integrated Memory**
Strength	Detailed	Stable	Detailed and Stable
Weakness	Unstable	General	-

3.3.4 Assertion in QM3

The final stage within the Quranic Memory Model (QM3) is assertion. Here, the learner consciously recalls the series of ayat memorized for the surah. This usually involves sequential recall whereby the learner recites the surah from beginning till the end. Proper implementation of acquisition, abstraction and absorption would assure the fluidity of uttering the surah from memory. To upscale the act of assertion, the model also proposes recognition as well.

Recognition is the act of the learner in recalling a certain ayat by the experience gained in everyday life (Nagy & Szamosközi, 2014). For instance, after memorizing surah 94:5 and 94:6, the learner is equipped with two cues. They are hardship and ease. This offers a catalyst to the learner to contemplate upon the ayat every time the concept of hardship is faced in life. In other words, whenever the learner encounters a situation of which difficulty is present, the ayat would automatically come to mind.

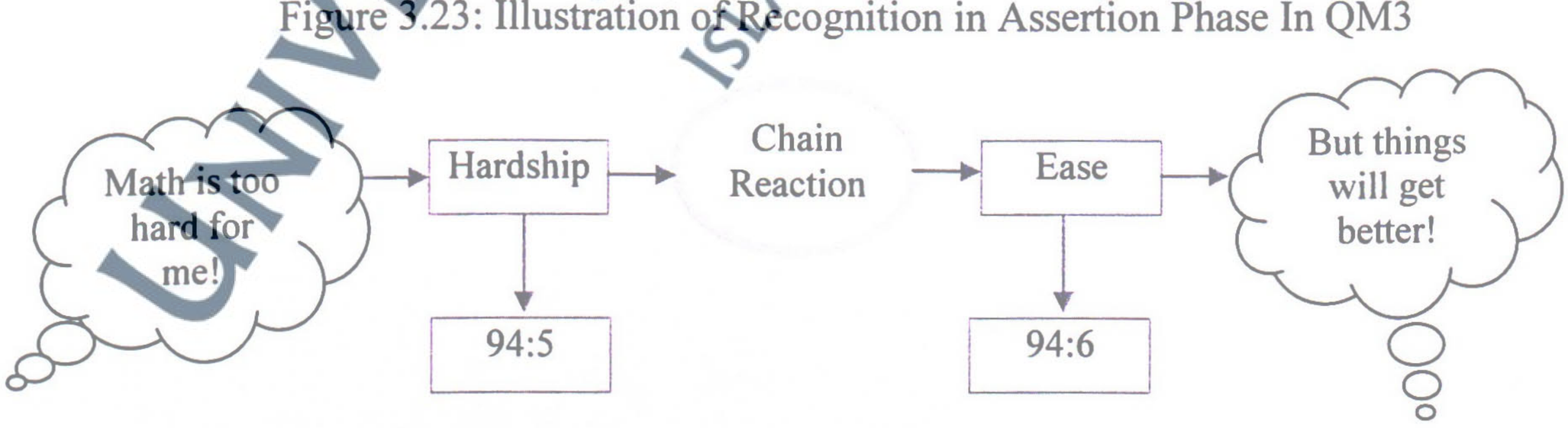
Figure 3.22: Cue Extraction forSurah (94), Verse 5 and 6

94:5
For indeed, with hardship [will be] ease
Cue: hardship (Al-Quran. Surat Ash-Sharh 94:5)

94:6
Indeed, with hardship [will be] ease
Cue: ease (Al-Quran. Surat Ash-Sharh 94:6)

For the sake of demonstrating the importance of recognition, assume that the learner is having some difficulty of passing a mathematics examination. This should instigate the activation of the hardship, which in turn stimulates the retrieval of the ayat 94:5 from memory. Upon the triggering of the hardship cue, the ease cue might be actuated due to a chain reaction, and the learner will be reminded that the difficulty encountered will be followed by relief.

Figure 3.23: Illustration of Recognition in Assertion Phase In QM3



With recognition, it is easier for the learner to appreciate a particular content of the Quran. This attempt is far from trivial. Appreciation is crucial because it imbues the ayat with strong emotions. Now, it is psychologically known that emotion is related to memory (Kang et al., 2014). Stronger emotion cultivates a stronger impression of memory and vice versa. Therefore, by initiating recognition through the application of cues, it is hoped that recognition can be enhanced for the purpose of a better memory.

3.4 EXPERIMENTATION PROCESS

The process of the experimentation which has been done in the classroom is explained in details in this section.

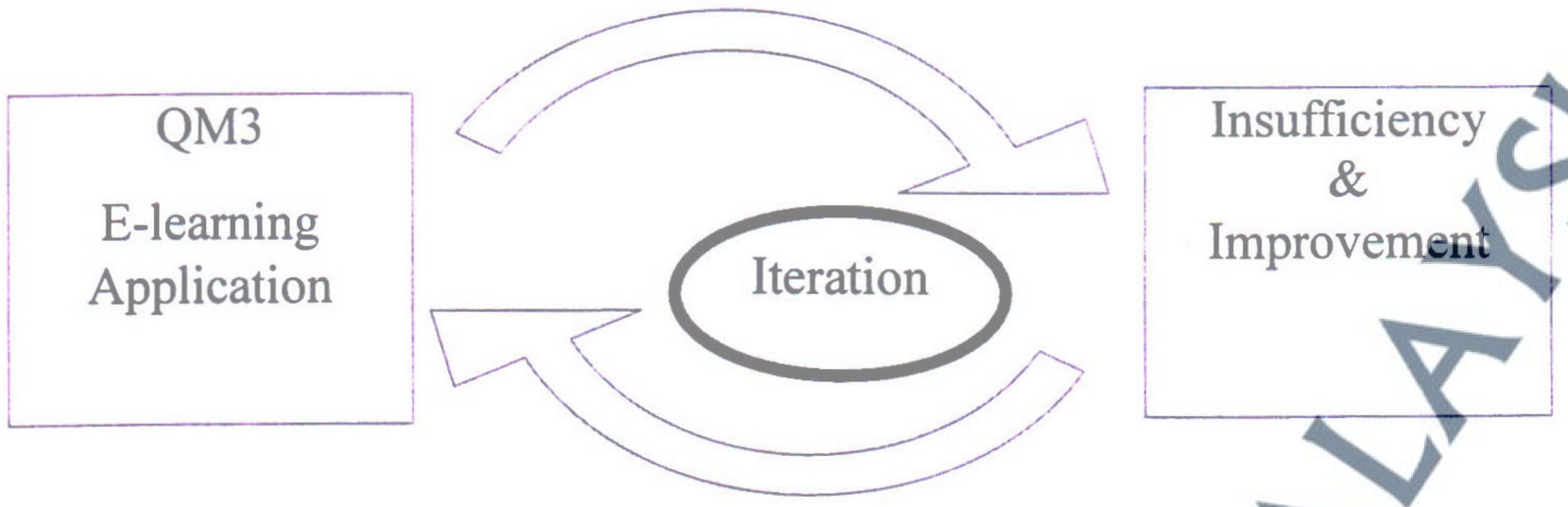
3.4.1 E-Learning Development

In order to conduct the experimentation, a materialization of the proposed model is required. This compels the development of an e-learning application (Franklin, 2014; Sharahi & Pasandideh, 2014) using the PHP (Guminska & Madejski, 2007) programming language that bears a rather favorable position in the internet industry. It runs on an Apache server (Aydin & Tirkes, 2010) that comes with the XAMPP web solution package (Brown, 2008). The usage of XAMPP is motivated by the convenience of installing the technological platform on any machine.

The application is then built using the principles and ideas recommended by the Quranic Multimedia Memory Model (QM3). As such, the structure and interface of the e-learning application adheres to the components of the model such as schematization and cue. This is a feat because translating the model into an actual application is a complex process. The migration from theory into practicality (Reinig, 2010; Anderson, 2008) is not as straightforward as expected.

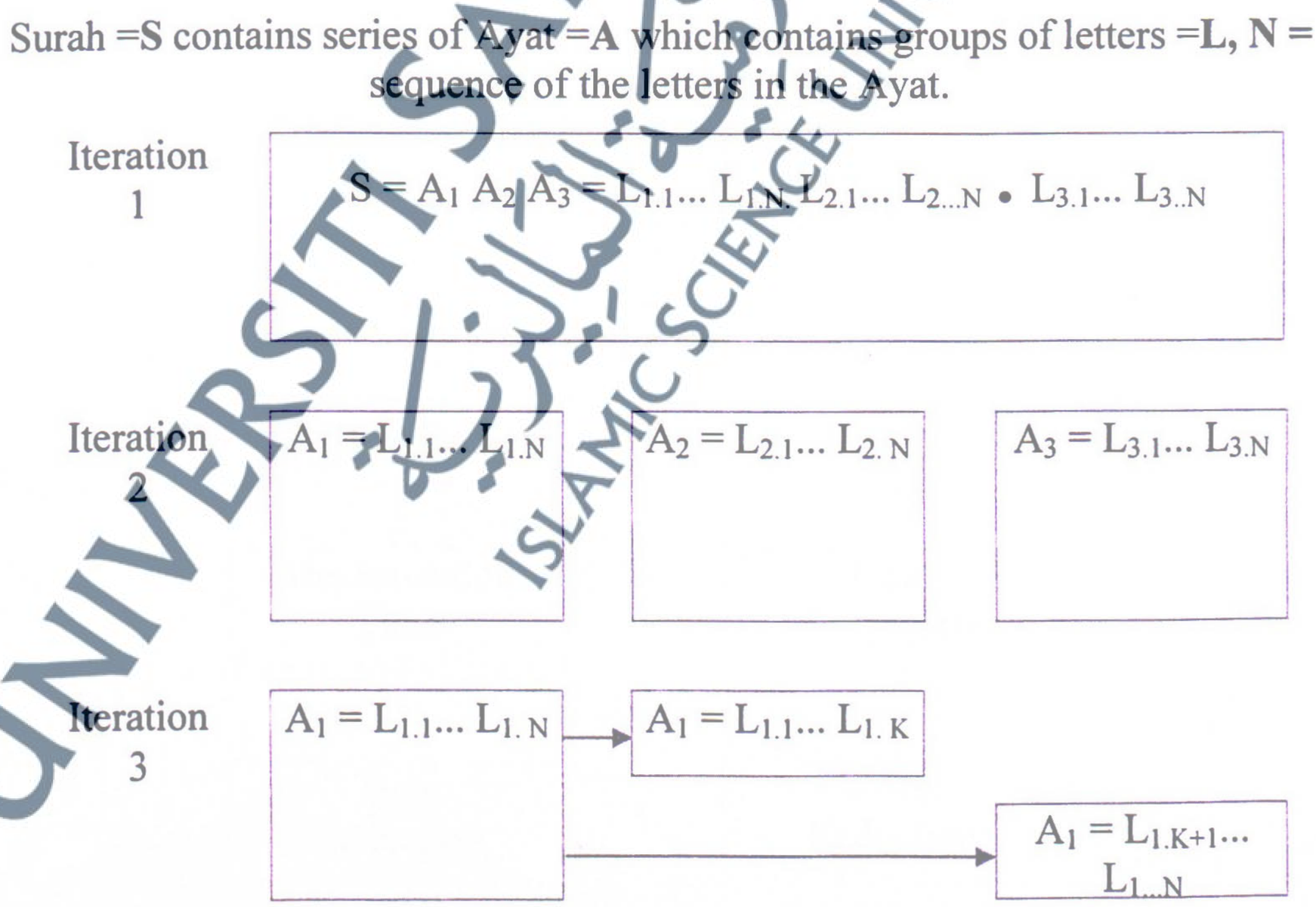
Constructing the application is therefore performed in recurring stages to manage the inherent complexity that would arise along the way. It follows the tenet of iterative development (Moniruzzaman & Hossain, 2013; Ali Munassar & Govardhan, 2010). To clarify (Figure 3.24), a simple version of the application is initially formed for the research although it does not resemble QM3 closely. In each iteration, the insufficiency is identified and improved upon. This is repeated until the application follows the intricacy of the model more closely.

Figure 3.24: Iterative Development



To demonstrate the importance of iterative development, consider the notions recommended by the proposed model (Figure 3.25). One of them is decomposition. It posits the importance of breaking down a complex artifact into simpler units. The idea is initially developed without decomposition whereby the entire collection of ayat from the surah is allocated in one page. Afterwards, decomposition is employed by dedicating a page for each ayat. Finally, each ayat is given its own page through proper chunking.

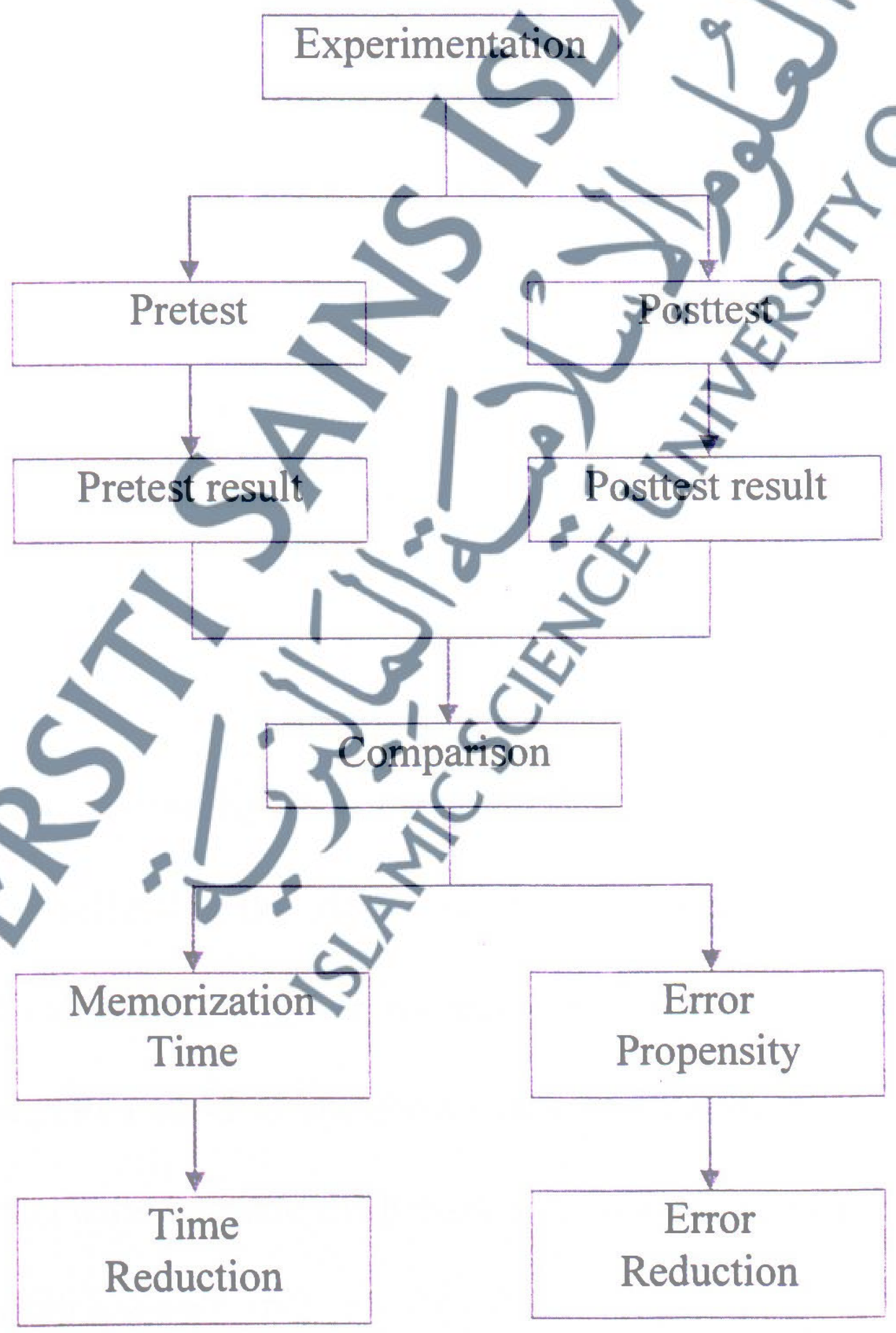
Figure 3.25: Example of Iterative Development



3.4.2 Research Design

The research emulates the one group pretest – posttest experimental design (Kirk, 2009; Dimitrov & Rumrill, Jr., 2003; Shadish, Cook & Campbell, 2002), of which the same participants are studied before (pretest) and after (posttest) a particular intervention is applied (Dunning, Holmes & Gathercole, 2013). The intervention in question here is the proposed approach of enhancing memory called the Quranic Multimedia Memory Model (QM3). In Figure 3.26, the overview of the entire design for the experimentation is laid out.

Figure 3.26: Experimentation design for quran memorization



3.4.3 Research Hypothesis

There are two hypotheses to be tested for the research (Hudak, 2012). The first one is related with the capacity of the model to enhance the rate of memorization (Mishra, 2011; Mishra, 2006). This is exhibited by the reduction of memorization time per letter from the Quran. The second hypothesis deals with how much it can improve the accuracy (Houston, Clifford & Phillips, 2013; Pierce & Gallo, 2011) of reciting the Quran from memory. This is signaled by the reduction of error (Unsworth & Brewer, 2010) in retrieving and citing the Quran.

H_1: Participants employing QM3 would exhibit a significantly reduced memorization time as compared to those utilizing the traditional approach of memorizing the Quran.

H_2: Participants employing QM3 would exhibit a significantly reduced error propensity as compared to those utilizing the traditional approach of memorizing the Quran.

Finally, the first and second hypotheses would determine the combined benefit of the proposed model in reflecting the effectiveness of the memorization strategy (Li, J. & Chun, 2012). The strongest impact is projected when both hypotheses are statistically significant. On the other hand, if one shows significance while the other does not, then the proposed model offers a trade-off between the two; For instance, a faster rate at an increased error or vice versa.

3.4.4 Research Material for Experiment

The material for the experiment was a set of sentences (Baddeley, Hitch & Allen, 2009) or ayats from the Quran. Five sentences were chosen randomly (King et al., 2011; Rohde, 2002) for both of the pre-test and post-test on the basis of two steps randomization (McQueen, 2009). In the first step, a random surah was selected from a total of 114 surah inside the Quran. Each surah consisted of different sentences. As such, in the second step, five random and contiguous sentences were derived from the random surah chosen from the previous step. If the starting point K of the random ayat did not expand sufficiently, the ayat from the next surah was taken in sequence. To clarify the two step randomization, consider the procedure below (Figure 3.27).

Figure 3.27: Procedure of two step randomization for material selection

Two Step Randomization

Q	= Quran
Total (Q)	= 114 be the total number of Surah in the Quran
S	= Surah from S_1.. S_{114} (Set of Surah in the Quran)
A	= Ayat within a Surah S
N	= total random ayat to be selected = 5
K	= starting point of random ayat
K (N)	= K, K+1, K+2, K+3, K=4

STEP 1:

Surah S = select a random surah from S_1.. S_{114}

Total (S) = total ayat in surah S

STEP 2:

$A = A_K, .. , A_{K+4}$ = select five contiguous random ayat from S

IF (K+4 > Total(S)) THEN

Y = Total(S) – K

S = (S+1) mod 114 + 1

$A = A_K, \ldots, A_{Total\ (S)} , A_{Y-1} , A_{Y-2} , \ldots , A_{Y-X}$ where Y-X = 0

ENDIF

For the purpose of illustration, consider the scenario of implementing the two step randomization at the pretest. As such, a random surah **S** from $\mathbf{S_1}$ .. $\mathbf{S_{114}}$ will be elected. After it is deployed, assume that surah $\mathbf{S_{36}}$ from the Quran is chosen randomly (Khajehei, H. & Shakarami, 2012). Now, this surah contains **83** ayat or $\mathbf{A_1}$... $\mathbf{A_{83}}$. Thus, if a total of **N** contiguous ayat (Lin, Ng & Kan, 2011) must be extracted then **A** = $\mathbf{A_K, A_{K+1}, \dots, A_{K+N-1}}$ where **K** is random and$\mathbf{1 \leq K \leq 83}$.

Since **K** is random and it can occur anywhere within the surah S, a problem arises when the position is at the end of the surah. For instance, supposed that **K = 81** and a total of five random ayat is needed. Therefore, **A = A** = $\mathbf{A_K, A_{K+1}, A_{K+2} = A_{81}, A_{82}, A_{83}}$. Here, **K+4 = 85 > 83** = Total(S). In other words, the total ayat is just three instead of five. To fulfill the requirement, the ayat from the next surah **S+1** is considered.

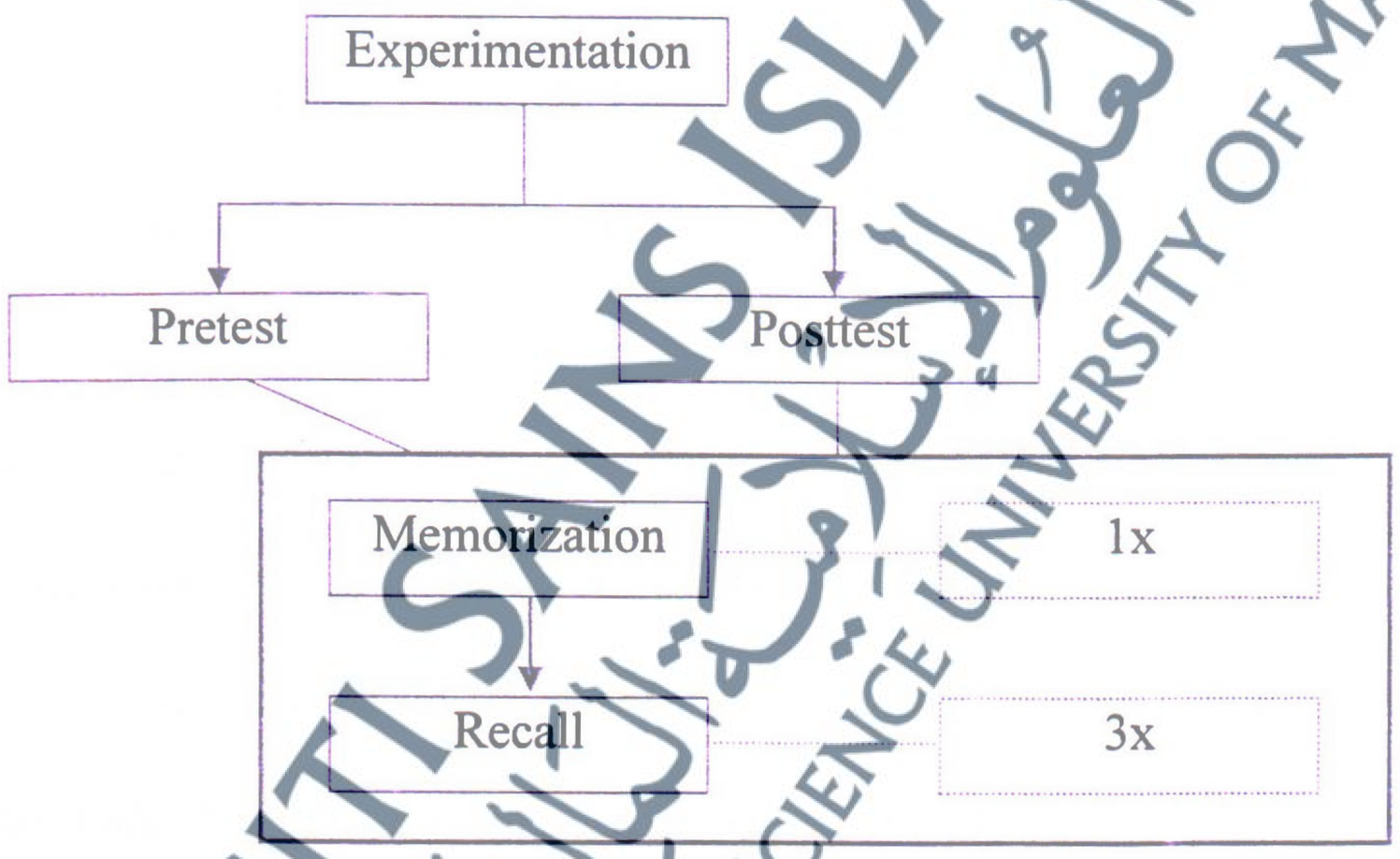
Only an addition of two ayat was required to complete the quota of five. Therefore, they were acquired from surah $\mathbf{S_{37} = S_{36+1}}$ which was the next surah. The ayat were taken sequentially without the need of any form of randomization. This way, the contiguity can be maintained (Irmer, 2010) without complication. It was helpful to point out that if this problem occurred at the last surah $\mathbf{S_{114}}$, then the next surah $\mathbf{S_1}$was nominated.

Randomization prevented any bias from being instigated by the research design. It was hypothesized that certain surah in the Quran were more demanding than others. As a consequence, this perception of difficulty can induce stress (Lempert et al., 2012) and interfere with memory (Beckner, 2004). Thus, even the numbering of the ayat was omitted.Furthermore, the material can be memorized without any preconceived struggle.

3.4.5 Research Measurement of Experiment

The recall of each participant was tested three times for both the pretest and posttest. In other words, they were asked to memorize a series of letters $\mathbf{L_1}$.. $\mathbf{L_N}$ from the Quran and then, their memory was examined through a repeated measure (Ishigami et al., 2013; McCrum-Gardner, 2008; Quene, H. & van den Bergh, 2004). Observe the following illustration in Figure 3.28. The memorization occured only once;however, the actual test of recall was performed three times.

Figure 3.28: Repeated measure for quran memorization



Repeated measure was critical in this case to improve the accuracy of the measurement (Seltman, 2012) of which the mean was taken. Given the fact that the participants were given only three minutes to memorize the content, it can be reasoned almost certainly that the impression was only present within the short term memory. The measurement of short term memory may not be as stable as long term memory (Yuan et al., 2006). Thus, the repeated measure was deemed necessary.

3.4.6 Research Sample Size

The number of sample for the experimentation was thirty five students (Gurevich, Johnson & Goldberg, 2010). To explore the viability of conducting the study with the aforementioned sample size (Henry, 2013; Eng, 2003; Bartlet, Kotrlik & Higgins, 2001), a variety of literature on related researches were gathered. The articles were chosen based on their degree of relatedness to the research at hand. Nearly all of them were associated with the research on memory. Some, however, were more connected on the study of reading, which was still a part of the process for the research when contemplated in retrospect.

A total of twenty articles in Table 3.6wereexplored for the purpose of proving the feasibility of the sample size. The number of participants within the collection laid within the range of two to forty. They were grouped based on four main categories in a descending order, namely **≥ 30, 20 – 29, 10 – 19** and **< 10**. Each class contained four to six articles for perusal and reflection. Overall, this provided a reasonable support for the choice of sample size for the study. Evidently, the total participants included within the study should not be an alarming cause of concern.

Table 3.6: Approximately Similar and Lesser Sample Size of Study

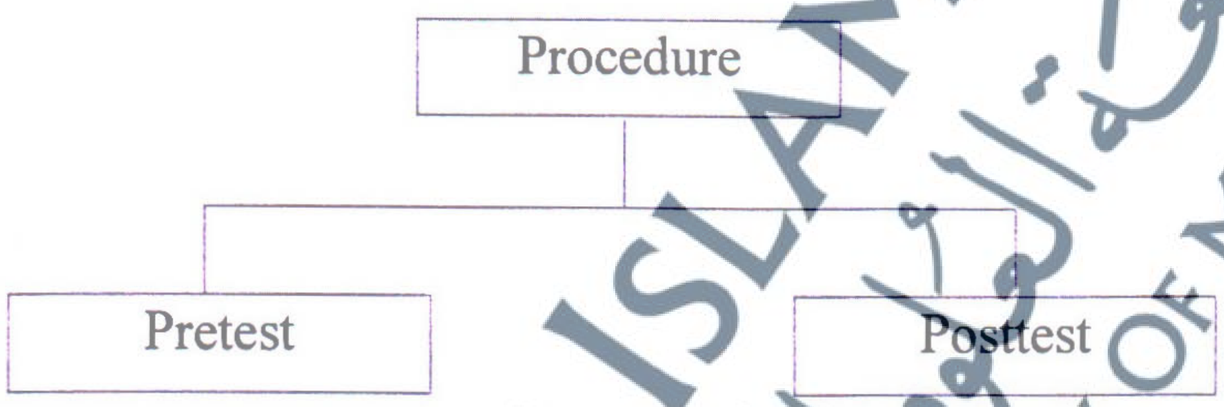
Sample Size Category	Sample Size (Actual)	Reference	Description of Study
≥ 30	40	(Zulkiply, 2013)	The long term retention of memory
	39	(López-Frutos et al., 2014)	Working memory of epilepsy patients

	34	(García-Paciosa, Del-Ríob & Maestúb, 2014)	Negative impact of anxiety on working memory
	33	(Ahmadi et al., 2010)	Effect of writing on working memory under depression
	32	(Bhandari & Duncan, 2014)	Role of chunking in cultivating behavioral novelty
	31	(Rudner et al., 2013)	Linguistic and processing influences of working memory
20 - 29	25	(Schweizer & Dalgleish, 2011)	Capacity of emotional working memory
	25	(Kühnel et al., 2013)	Synergy of priming with semantic and episodic memory.
	21	(Oberauer & Kliegl, 2006)	Formalizing the capacity of limitation of working memory
	20	(Graves et al., 2014)	Memory in reading skill and structural representation
10 - 19	18	(Shilko, Dormasheva & Romanov, 2012)	Interplay of attention and memory in Stroop Effect
	16	(Murray, Nobre & Stokes, 2011)	Predicting the performance of short term memory
	16	(Mengoni, Nash & Hulme, 2014)	Procedural knowledge of memory in learning to read new words
	16	(Levy, Fedorenko & Gibson, 2013)	Memory oriented prediction of clauses difficulty in Russian
	15	(Arjmandnia, Kakabaraee, & Afrooz, 2012)	Effect of rehearsal on working memory
	14	(Yeh et al., 2014)	Impact of working memory capacity on problem solving
< 10	8	(Kathryn et al., 2014)	Importance of sleep in fortifying memory
	7	(Allen & Martin, 2010)	Short term memory in task switching
	5	(Skiada et al., 2014)	Mobile application to enhance short term memory
	2	(Yoshidaa, Hiraia & Miyaji, 2014)	Electroencephalograph feedback effect of memory

3.4.7 Procedure of Experimentation

The procedure was divided into two phases, namely the pretest and posttest (Figure 3.29). In the pretest, the benchmark (Nam & Smith-Jackson, 2007) of the experimentation was established. Here, the participants were asked to memorize a series of surah from the Quran using the traditional way (Mustafa & Basri, 2014). Then, they were tested by the speed and accuracy of recall.

Figure 3.29: Procedure of experimentation for quran memorization



For the posttest, the participants must memorize a different set of surah from the Quran within the same duration of time allocated for the pretest. However, the effort was done via the proposed model QM3. Both approaches utilized the e-learning paradigm (Bostrom, 2012) of which the participants interacted with the online system to learn the content without the supervision of the educator.

Subsequently, the results from the pretest and posttest were compared (Pratt, McGuigan & Katzev, 2000) with one another to ascertain two forms of evaluations. The first evaluation was the memorization time. It entailed the average time needed by the participants to memorize a letter from the Quran. The next one was the error propensity. This denoted the probability of making an error in memorization.

3.4.7.1 Pretest Procedure in Experimentation

The material for the pretest was presented using an e-learning system (Figure 3.30). A total of five Ayatwere taken randomly from the Quran for this task. The name and numbering of the surah were not imparted to the participants to ensure a better objectivity. All the Ayatwere placed in one page to mimic the actual learning environment of the participants in memorizing the Quran the traditional way (Figure 3.31).

Figure 3.30: Interface of pretest for traditional approach

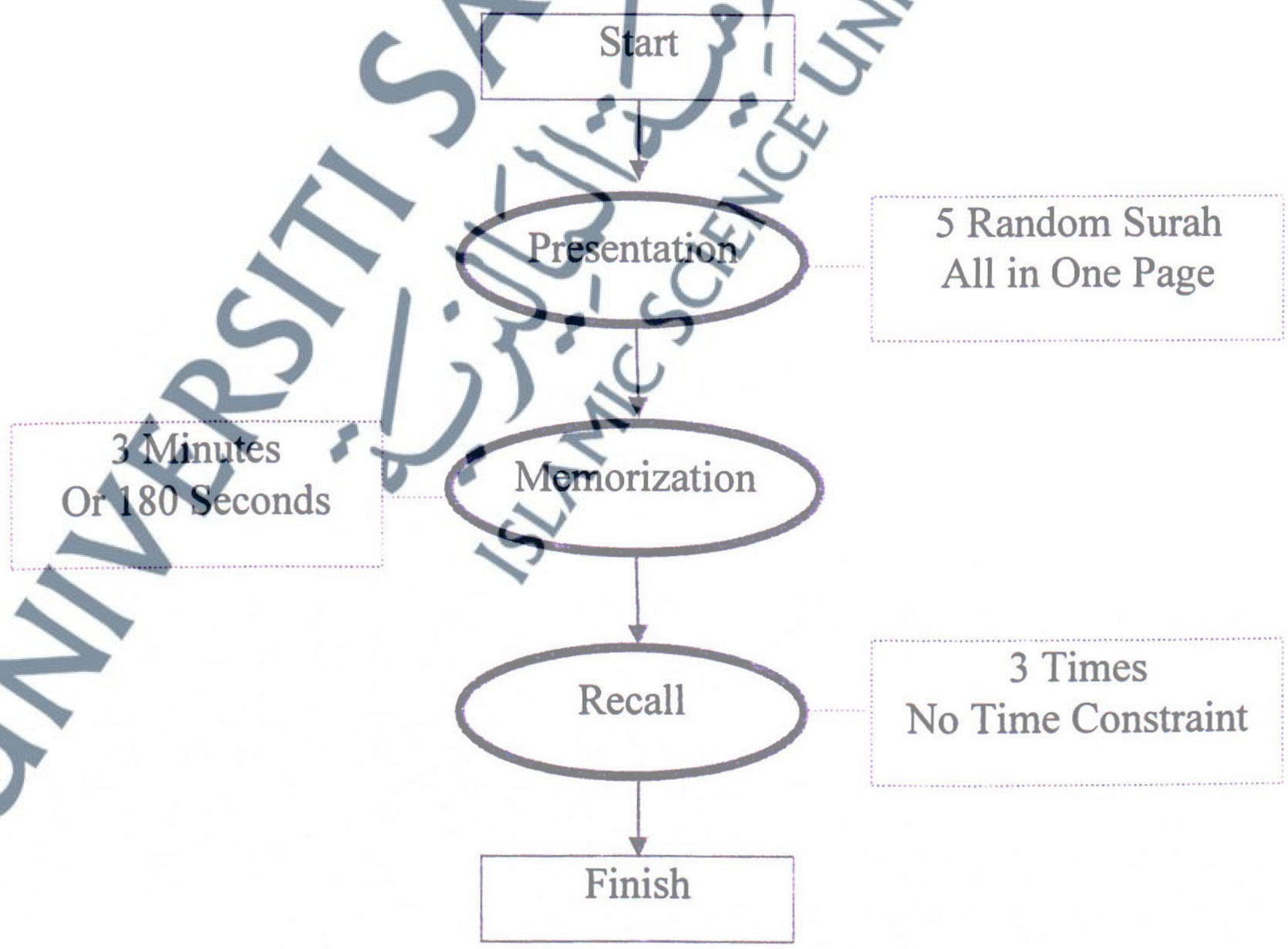
Figure 3.31: Layout of pretest aligned with traditional memorization

$S_1 = A_1 \ldots A_N$
$S_2 = A_1 \ldots A_N$
$S_3 = A_1 \ldots A_N$
$S_4 = A_1 \ldots A_N$
$S_5 = A_1 \ldots A_N$

The time given for the memorization task was set at **3** minutes (Huchendorf, 2007; West, S. A. 2010) or **180** seconds. Once the time was up, the participants immediately stopped their endeavor. Then, they were asked to recite their memorization to the experimenter. The participants must vocalize (Aboitiz, 2012) the surah in mind for three consecutive times. This provided a better measure for the study.

Recitation was recorded using the audacity software (Slater et al., 2013). Here, the experimenter assisted the participants to avert any distraction (Röer, Bell, Buchner, 2014; Strayer, Watson & Drews, 2011; Sörqvist, 2010) from taking place. There was no time constraint imposed for the recitation. Sometimes, the participants may pause (Dall et al., 2014; Prince, 2004) for a few seconds to gather their thoughts. This was allowed since the speed of recall was not within the scope of the study. The overall process for the pretest was given below (Figure 3.32).

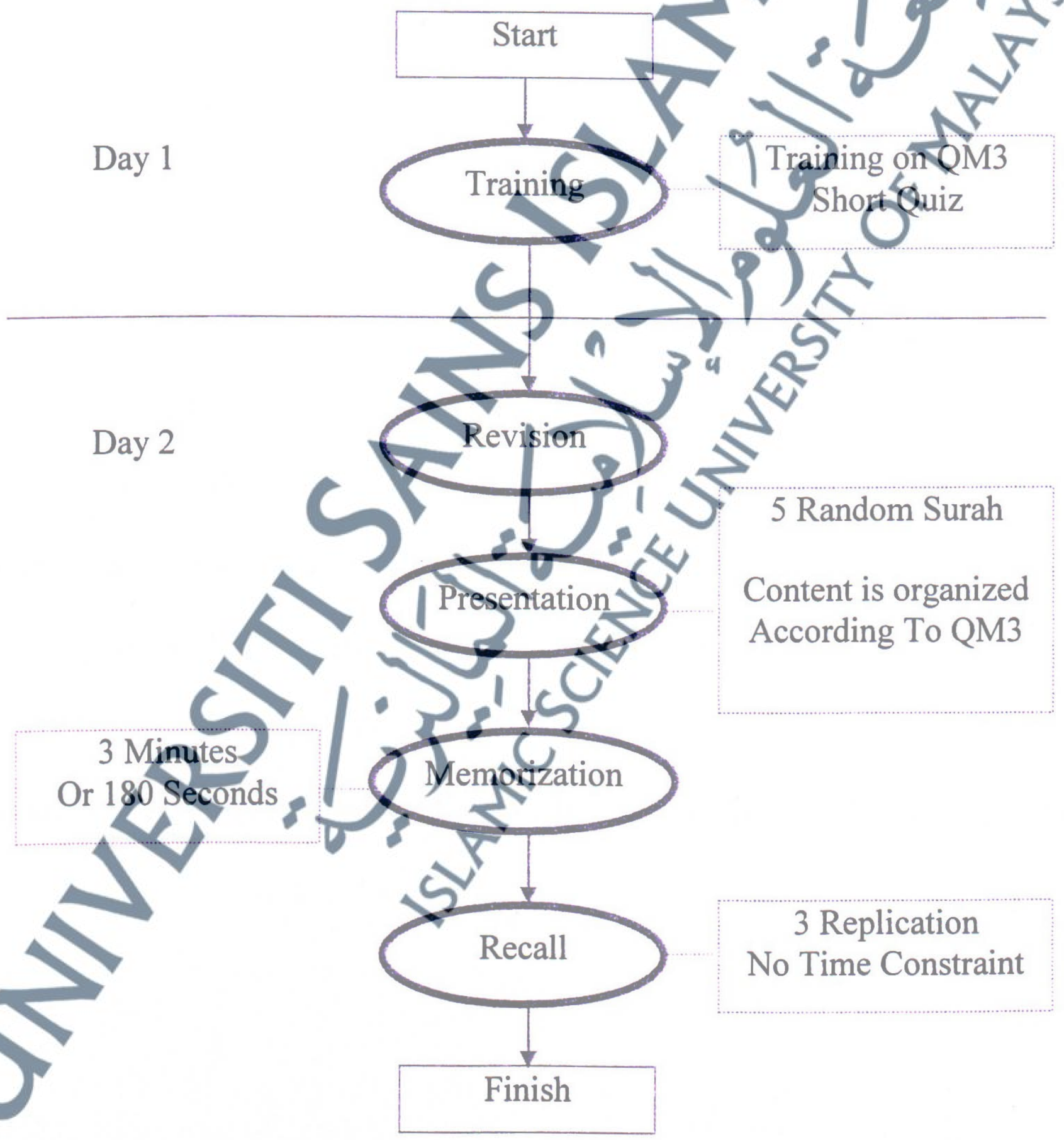
Figure 3.32: Flow chart of pretest



3.4.7.2 Posttest Procedure in Experimentation

Posttest (Figure 3.33) was preceded with a lesson on how the new model of memorization QM3 can be employed by the participants in memorizing. A training session (Dunlosky et al., 2013; Melby-Lervåg & Hulme, 2013) was conducted to explain the approach as well as the practical mechanism (Iglesias-Parroa, Gómez-Arizaa & Arias, 2009). After the training, a short quiz (Mestre & Ross, 2011) was held to check the understanding of the participants. The training was done in one day.

Figure 3.33: Flow chart of posttest



Training was crucial to guarantee that the participants were well versed with the method before the actual testing can transpire. A demonstration (Iline, 2013) on how the method can work in an actual setting was also imparted to the participants to increase their confidence on using the proposed model. They were also encouraged to inquire anything that may pose doubt or concern to their memorization.

As shown in Figure 3.33, the posttest was segmented into two days. The first day was the training session to teach the approach. Then, another day was allocated for the actual testing. The sleeping process (Diekelmann & Born 2010) in between will help the participants to consolidate the learned technique. A short revision was also conducted prior to the posttest to prepare the participants properly.

The posttest was implemented in a rather similar fashion of the pretest. The main difference was the material presented. Unlike the material in pretest that was arranged completely in a page, the posttest material was organized according to the principles recommended by QM3. Here, the surah to be memorized was divided into several pages (Soto & Humphreys, 2007) and supported with a cue **C** (Figure 3.34) that was strategically located at the beginning of the page (Maxcey-Richard & Hollingworth, 2013).

Figure 3.34: Layout of posttest aligned with quranic multimedia memory model

$$C = C_1 \ldots C_N$$

$$S_1 = A_1 \ldots A_N$$

$$\ldots$$

$$S_5 = A_1 \ldots A_N$$

3.5 Data Collection

The study utilized random method in selecting the Ayat for each of pretest, posttest and observation with Libyan schools students in Malaysia. Furthermore, data collection was conducted through the pretest – posttest experimental design. For the sample, 35 participants from a Libyan school were selected. To perform the pretest, they were tested in terms of their performance in memorizing a series of ayat from the Quran using the traditional way. Subsequently, they were exposed to the Quranic Multimedia Memory Model through a formal training at the classroom. This was followed by a posttest that demanded the memorization of a different set of ayat from the Quran.

3.6 Data Analysis

Statistical analysis will be carried out using the primary tool to analyze data which was the Statistical Package for Social Sciences (IBM SPSS Statistics software SPSS version 20) to analyze the data of instruments for pre and posttest and observation. On the other hand, collected data from the evaluation of teaching multimedia application in the market was analyzed in two sections: General Review and Specific Review of Arabic Multimedia Courseware in Markets, to find out the standard deviations, means, frequencies and counts as well as the percentage of the data. In addition, a mixture of inductive and deductive analyses was used to form collected data to make the statistical analysis.The researcher appliesone way analysis of variance(ANOVA) type to measure memorization time and error propensity from pre and posttest along with the differences among the applications.

3.7 Summary

In this chapter, the overview of the Quranic Multimedia Memory Model (QM3) is established to overcome the limitation of the traditional approach of memorizing the Quran, which can pose a constraint to the memory of the learner. QM3consisted of four main phases – acquisition, abstraction, absorption and assertion. The model offered improvement by layering the task of memorization in stages. This allowed the cognition of the learner to focus on one task at a time without being overwhelmed by the actual demand of memorization. It may also promote motivation when the process of memorization was portrayed as a feasible repertoire.

The study was conducted via the pretest – posttest experimental design. For the sample, 35 participants from a Libyan school were selected. To perform the pretest, they were tested in terms of their performance in memorizing a series of ayat from the Quran using the traditional way. Subsequently, they were exposed to the Quranic Multimedia Memory Model through a formal training at the classroom. This was followed by a posttest that demanded the memorization of a different set of ayat from the Quran. A comparison on their performance was analyzed from the perspective of memorization time and error propensity.