

# PhD Research Progress

Adaptive Educational Hypermedia Based on Multiple  
Student Characteristics



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# What is Adaptive Educational Hypermedia (AEH)?

- AEH is a combination of two technologies: hypermedia and intelligent tutoring system (ITS).
  - Hypermedia contains information supported by different media and connected by links.
  - ITS utilises a user model to adapt various visible aspect to particular user.
- AEH system can be defined as all hypertext and hypermedia systems that accommodate some student characteristics into a student model and apply this model to adapt various learning material presentations.
- AEH system is used to enhance learning activity in web-based distance learning environment.

# Why is AEH important?

- AEH extends the advantages of web-based instruction which are classroom and platform independence by offering learners personalised instruction in a distance learning setting.
- AEH overcomes some problems of WBI, such as:
  - providing the same information to all students
  - assuming that all students have a homogenous ability and preference.
- AEH can minimize the “lost in space” problem when using conventional hypermedia.
- Students need to get different learning material and order of presentation depending upon their own characteristics.

# What is multiple student characteristics?

- Every student has different characteristics.
- Learning process is complex and influenced by these characteristics, including
  - prior knowledge
  - learning styles
  - background/experience
  - preference, etc.
- It is important to accommodate these characteristics into the Student Model in order to generate accurate adaptation.

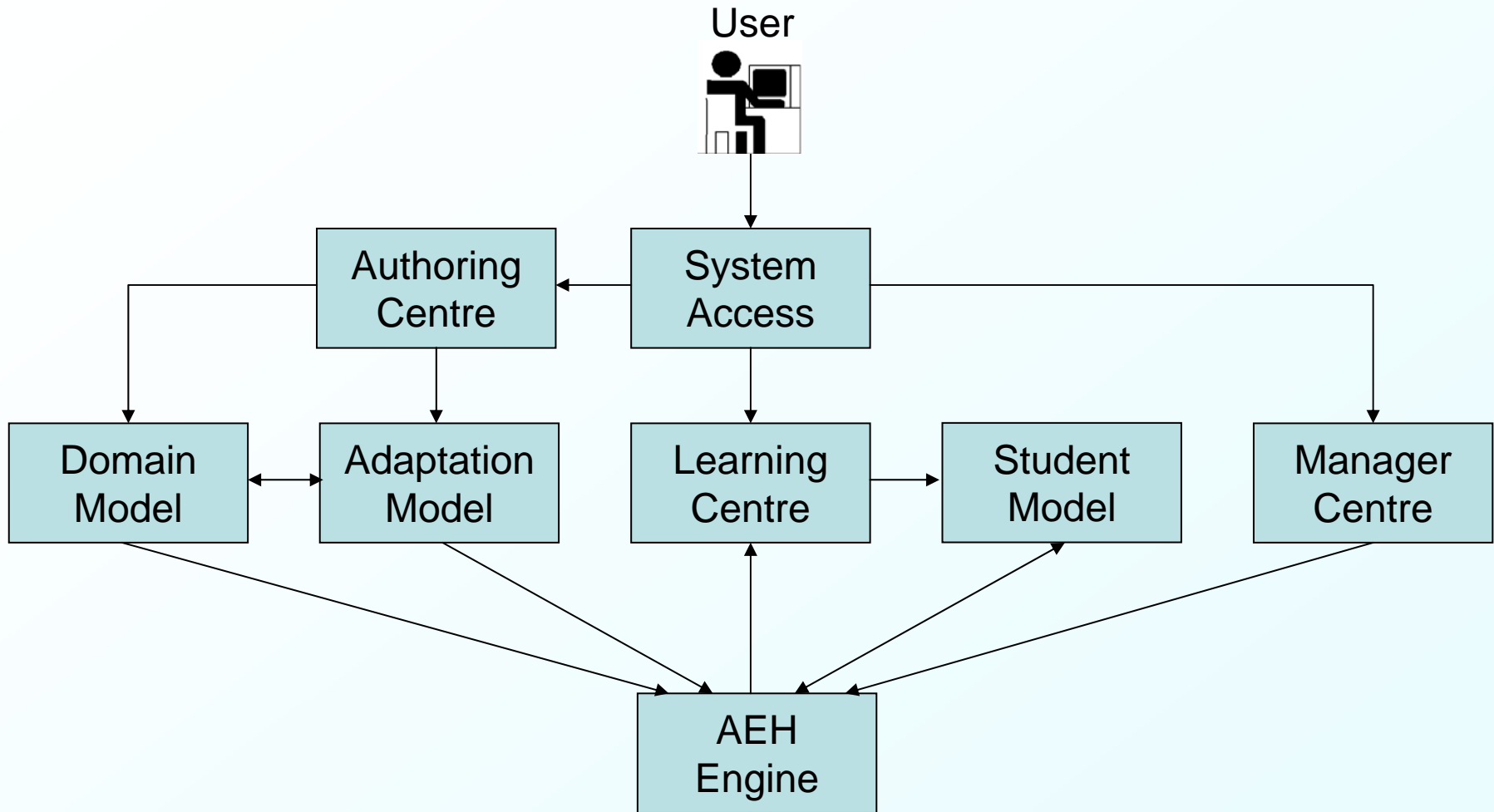
# What about existing AEH systems?

- There are many AEH systems currently available on the Internet.
- Problems of current AEH systems are:
  - capable of considering only a small number of student characteristics.
  - fixed and not easily expandable or adaptable to other subject matter.
- This AEH system incorporates student model that accommodates knowledge, learning styles, multimedia and preferences.

# Contributions of Study (revisited)

1. The proposed AEH will take into account multiple student characteristics, so that the adaptation will be more accurate and individualistic.
2. The adaptation and student models will be implemented as domain-independent components, so that it is possible to author other subject matter easily.
3. The proposed AEH will be developed in the domain of electronic theory targeted for university level students.
4. Compared to existing web-based learning systems, the proposed AEH has capability to adapt presentation to the individual needs.

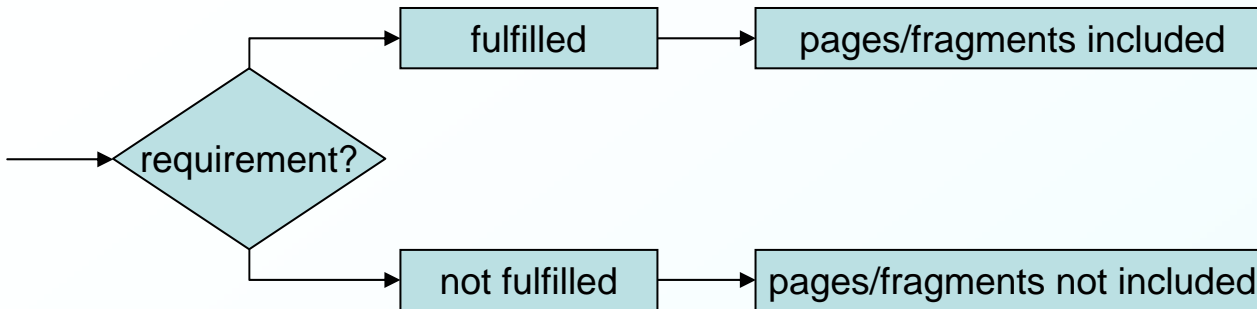
# System Architecture



# Adaptation Techniques Used in this AEH (1)

## 1. Adaptive Presentation

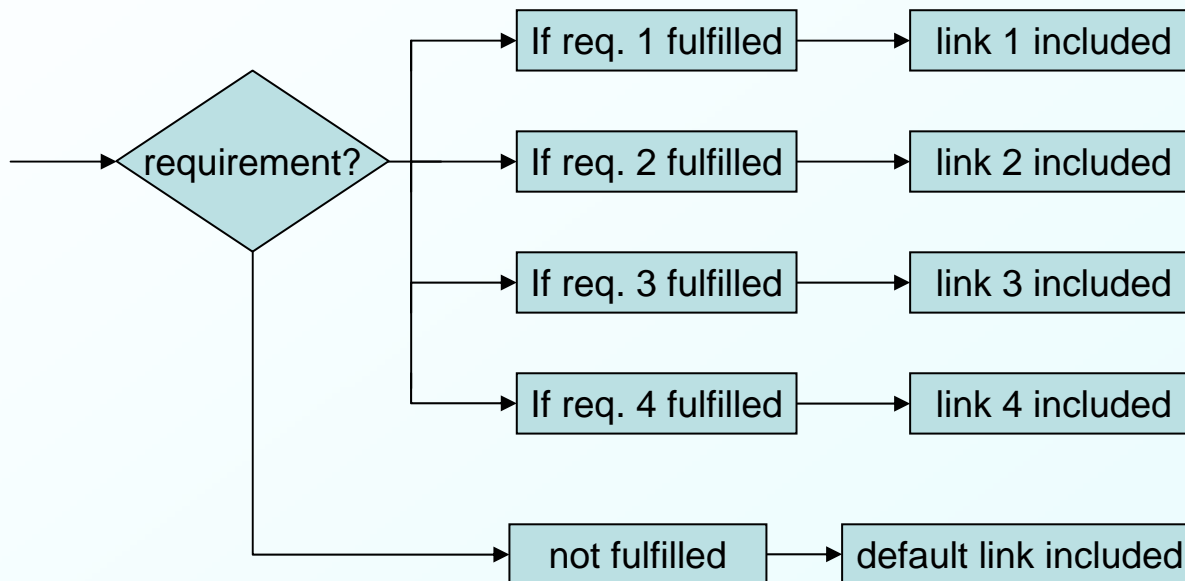
- Conditional inclusion of pages/fragments



Implemented in:

- All pages
- Multimedia features

- Conditional inclusion of links



Implemented in:

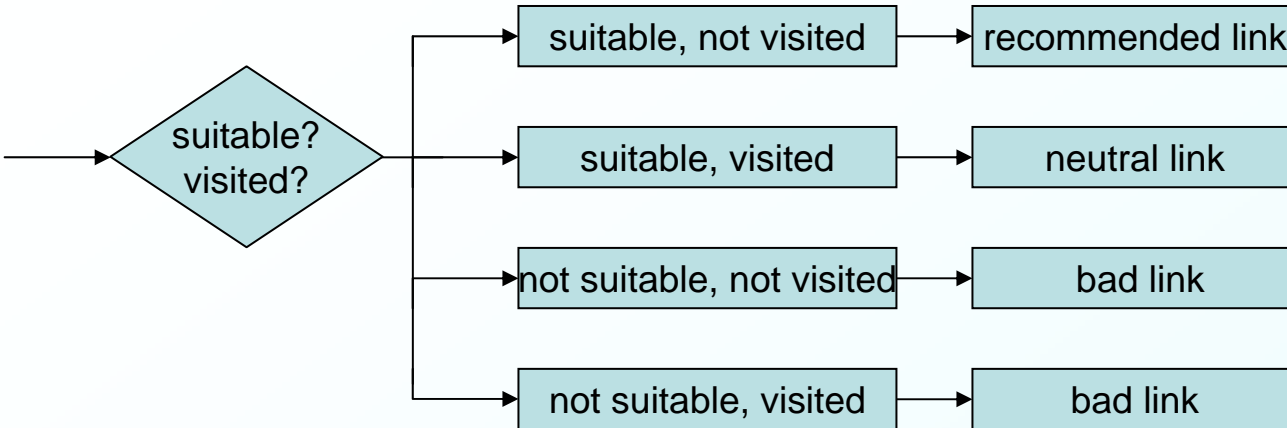
- Intro page



# Adaptation Techniques Used in this AEH (2)

## 2. Adaptive Navigation

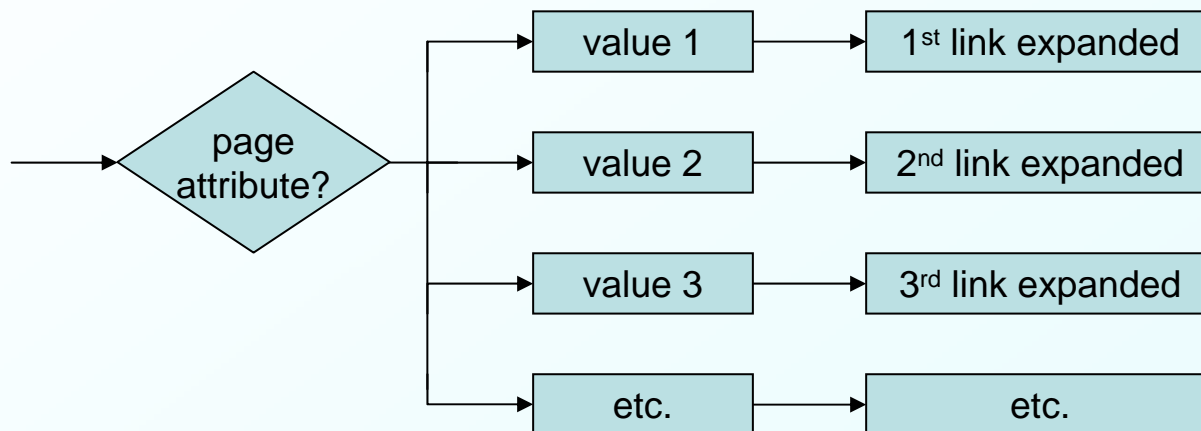
- Link hiding



Implemented in:

- All links

- Link expansion



Implemented in:

- Table of content

# Obtaining student characteristics

- System initialises default values
- System provides test to measure knowledge
- System presents questionnaires
- Students edit their own profiles

# Questionnaires

- Measuring student preference of learning styles (“sequential” or “global”) and multimedia (“visual/multimedia” or “verbal/non-multimedia”).
- Containing 22 questions (11 for LS and 11 for M).
- Possible results for learning styles:
  - LS = 11 and 9 ..... Very strong preference for global tutorial.
  - LS = 7 and 5 ..... Moderate preference for global tutorial.
  - LS = 3 and 1 ..... Little preference for global tutorial.
  - LS = -1 and -3 ..... Little preference for sequential tutorial.
  - LS = -5 and -7 ..... Moderate preference for sequential tutorial.
  - LS = -9 and -11 ... Very strong preference for sequential tutorial.
- Possible results for multimedia:
  - M = 11 and 9 ..... Very strong preference for non-multimedia tutorial.
  - M = 7 and 5 ..... Moderate preference for non-multimedia tutorial.
  - M = 3 and 1 ..... Little preference for non-multimedia tutorial.
  - M = -1 and -3 ..... Little preference for multimedia tutorial.
  - M = -5 and -7 ..... Moderate preference for multimedia tutorial.
  - M = -9 and -11 ... Very strong preference for multimedia tutorial.

# Tutorial Mode

- Based on the questionnaires results, student will be assigned to one of the four possible tutorial modes:
  1. Global and multimedia (If  $LS > 0$  and  $M < 0$ )
  2. Sequential and multimedia (If  $LS < 0$  and  $M < 0$ )
  3. Global and non-multimedia (If  $LS > 0$  and  $M > 0$ )
  4. Sequential and non-multimedia (If  $LS < 0$  and  $M > 0$ )
- If questionnaires are not filled, system will present global and multimedia tutorial as default.

# Tutorial Mode

## Mode 1

global and multimedia  
(If  $LS > 0$  and  $M < 0$ )

There is table of content

There is multimedia features

## Mode 2

sequential and multimedia  
(If  $LS < 0$  and  $M < 0$ )

There are navigation buttons

There is multimedia features

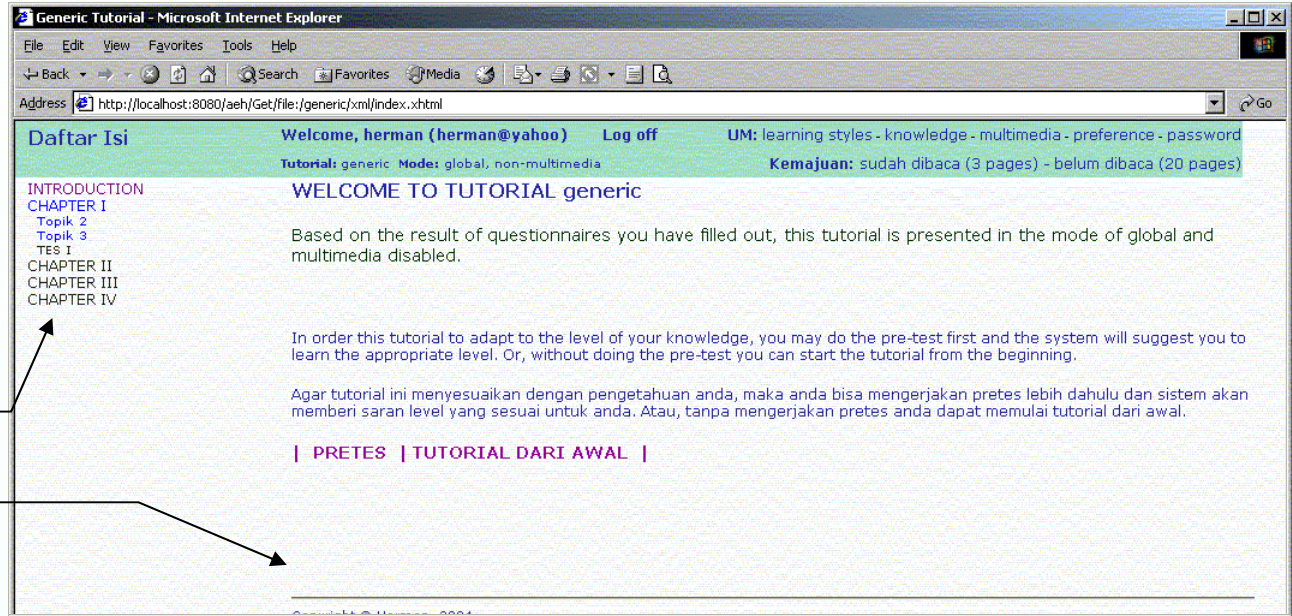
# Tutorial Mode

## Mode 3

global and non-multimedia  
(If  $LS > 0$  and  $M > 0$ )

There is table of content

There is no multimedia features

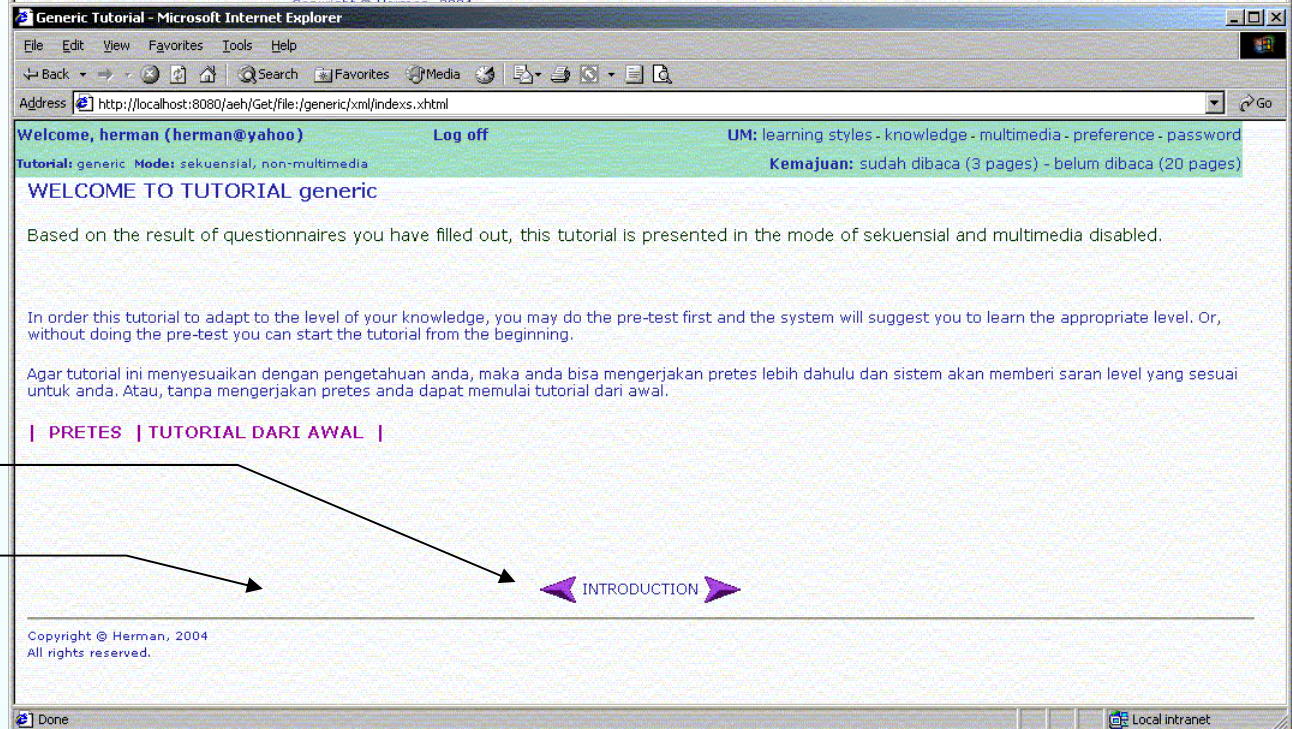


## Mode 4

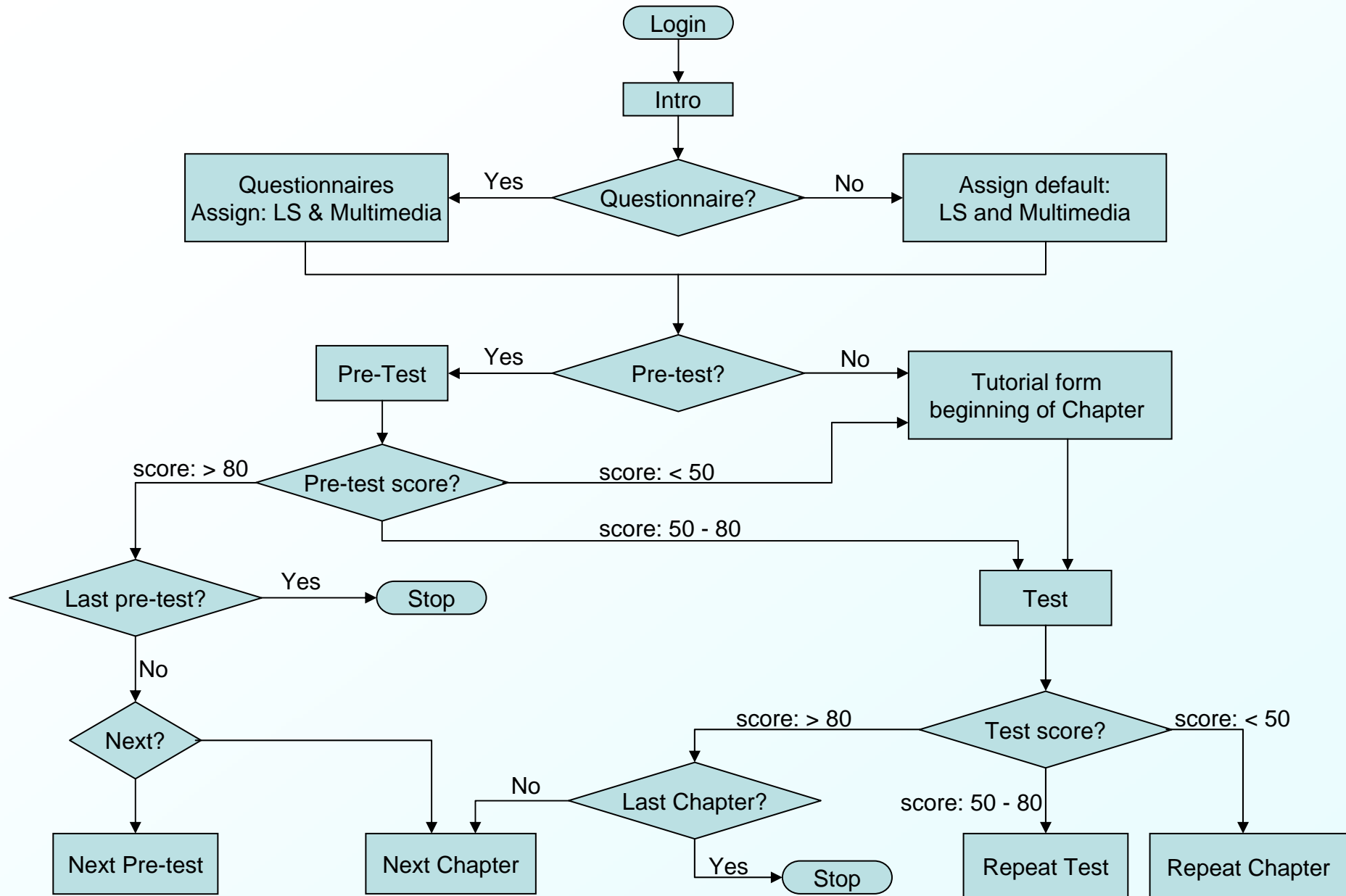
sequential and  
non-multimedia  
(If  $LS < 0$  and  $M > 0$ )

There are navigation buttons

There is no multimedia features



# Tutorial Flowchart



# Experimental Research

- An experimental research will be conducted in real educational settings to evaluate the effectiveness of the AEH system compared to non-AEH system.
- Diagram of the experimental design is shown below.

|                  |   |          |                             |           |
|------------------|---|----------|-----------------------------|-----------|
| Experiment Group | R | Pre-test | Treatment of AEH system     | Post-test |
| Control Group    | R | Pre-test | Treatment of non-AEH system | Post-test |

- Analysis of Covariance will be used to compare statistically between post-test scores of experimental group and those of control group by considering the pre-test scores of each group as co-factor.



# Conclusion

- The AEH system that is being developed is unique in that it
  - considers multiple student characteristics, so that the adaptation will be more accurate.
  - is a generic system, so that a teacher without any programming knowledge can author other subject matter.
- The experimental research will be conducted to evaluate the effectiveness of the AEH system.