

Development of Intelligent Tutoring System Framework: Using Scaffolding Teaching Strategy

Chandra Pal Singh (10305075)

Supervisor

Prof. Sridhar Iyer

Department of Computer Science and Engineering
Indian Institute of Technology Bombay

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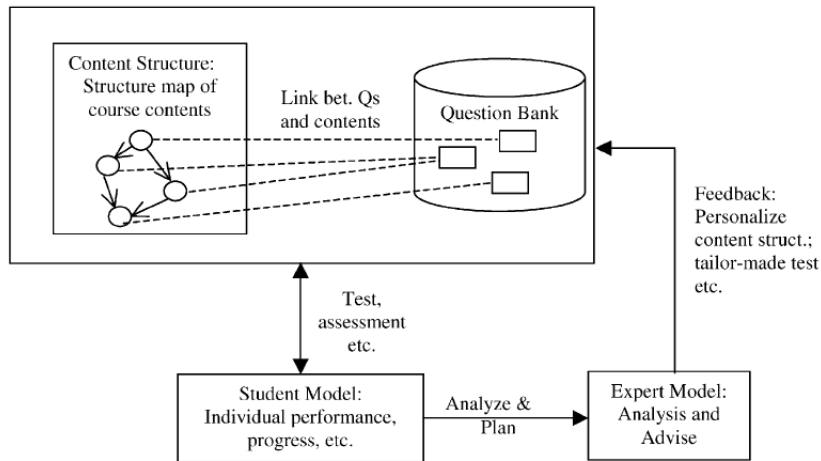
Outline

- Literature Survey: SmartTutor
- Literature Survey: Scaffolding Teaching Strategy
- Demo of ITS
- Implementation of ITS using scaffolding strategy.
- Integration of four strategies at one place
- Content Used for Testing
- Limitations of our ITS
- Conclusions

Literature Survey: SmartTutor[4]

- is a subsystem within the SPACE online universal learning (SOUL) system.
- is developed for teaching mathematics.
- explains the core knowledge of subject.
- provides examples from example module.
- suggests test papers from past performance.
- suggests next most efficient activity to do.

SmartTutor: Conceptual view of SmartTutor



Source: B. Cheung, L. Hui, J. Zhang and S.M. Yiu, SmartTutor: An intelligent tutoring system in web-based adult education, at The Journal of Systems and Software 68 (2003).

SmartTutor: Findings From Survey

ITSs, I have read (wayang outpost, smartTutor, Zosmat manager)

- have four common components.
- are made to teach only Mathematic.
- used only one teaching strategy called scaffolding.

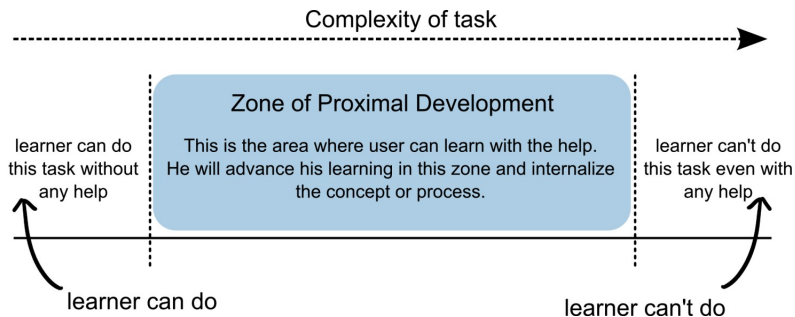
Our Solution

- to built a system which will support more than one strategies.
- to make ITS framework independent from subject domain.
- scope of system will be expendable.

Literature Survey: Scaffolding[1]

- In building construction scaffolding defined as “the structure built alongside a building when a brand new building is being built or when a building is being repaired. After the building is completed or the repairs are made, the scaffolding is removed.”
- Vygotsky defined scaffolding instruction as “the role of teachers and others in supporting the learner’s development and providing support structures to get to the next stage or level in ZPD” (Raymond, 2000, p.176)

Scaffolding: Zone of Proximal Development[2]



Source: Yogendra Pal's APS report: intelligent tutoring system to teach programming to bilingual students, IIT Bombay

Scaffolding: Examples of This Strategy[6]

Scaffolding instruction includes a wide variety of strategies:

- Activating prior knowledge.
- Showing students example of desired output.
- Offering hints or partial solution.
- Teaching students some shortcut methods.
- Teaching key vocabulary terms before reading.

Scaffolding: Is it helpful?[6]

Scaffolding:

- provides clear directions.
- keeps student on task.
- points students to worthy sources.
- delivers efficiency.

Scaffolding: In our case

- In our system hints and feedback is provided as scaffold.
- In our system all assistance is planned in advance.
- Our system will be considered as the expert and responsible for the scaffolding of learner.

Demo of ITS with only Scaffolding Teaching Strategy

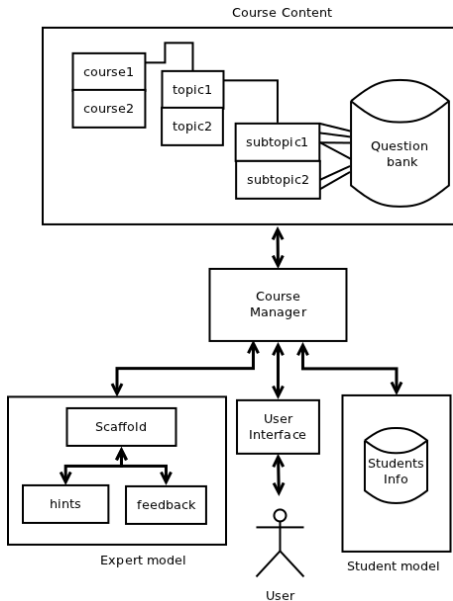


Figure: Components of ITS with Scaffolding only

Implementation: Approach for providing scaffold

- provide structured course for ZPD.
- provide question with four options.
- provide maximum 3 hints for each question (can be extended).
- student has level number.
- level number can be increased or decreased.
- hints used per question/subtopic is stored.

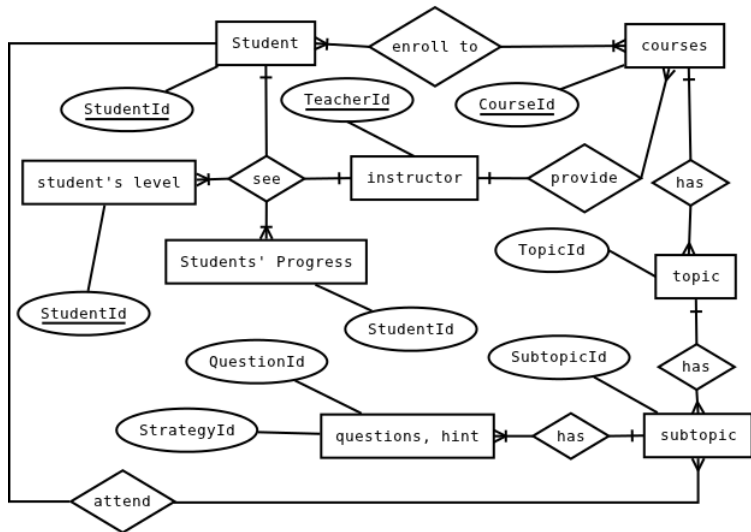
Performance of student = $((MO/TM) * 100 - (HU/TH) * weight)$

MO: Marks obtained, TM: Total marks

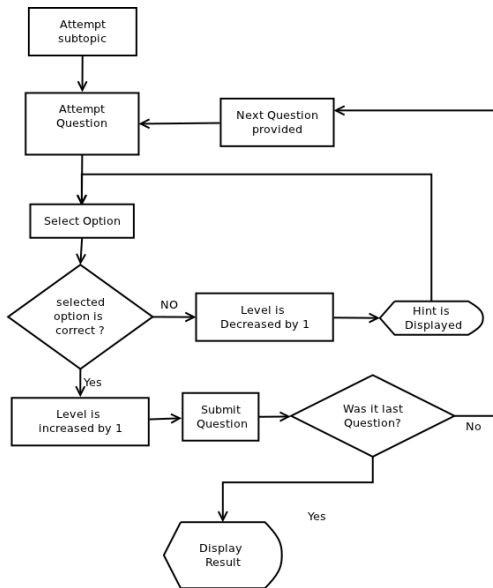
HU: # of Hints used, TH: Total hints available

weight: This is decided according to level of student.

Implementation: Top level E-R diagram



Workflow in ITS when Student attempt subtopic



Implementation: Design of Database for scaffolding

- login_table
- course_table
- topic_table
- subtopic_table
- question_table
- student_info
- student_progress_table
- student_level
- upload_resource
- student_response_table

Implementation: Modules used for scaffolding

- GUI module
- Login module
- Course module
- Topic module
- Subtopic module
- Question module
- Quiz presenter module
- Hint module
- Evaluate Question module
- Database handling module
- Result/report generator module

Integration of all strategies at one place

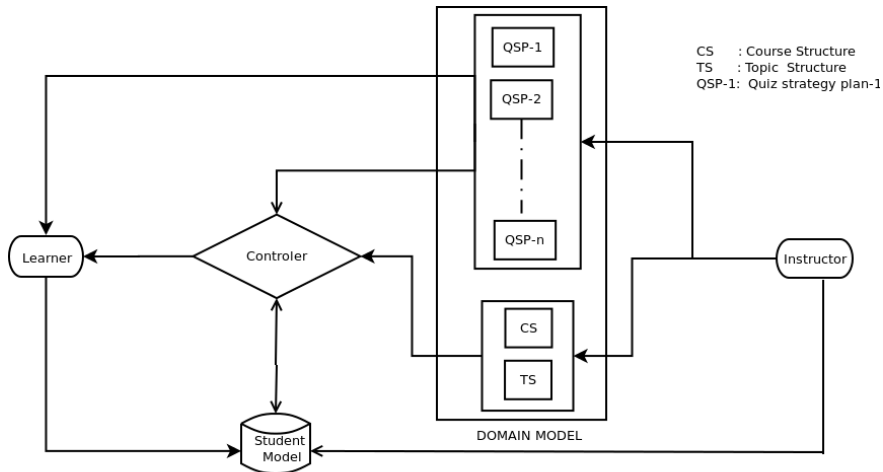
Modules used for integration:

- Strategy modules
- Strategy sequencing module
- Controller module

Tables used for Integration:

- Strategy table
- Strategy priority table

Top Level Architecture of ITS with four Strategy



Algorithm for Switching Strategy for student

- 1 Find the number of strategy available for the subtopic.
- 2 Find the strategy of highest priority among them.
- 3 If learner have used this strategy then find the learner's performance with that in last subtopic else provide questions with this strategy.
- 4 Compare performance with threshold set by instructor. if performance is \geq threshold then provide questions with this strategy else choose strategy of next high priority.
- 5 Repeat step 3 & 4 for all available strategy
- 6 Find highest performance in any strategy and provide questions with it.

Content used for testing: Format of questions

Course-Id: CS101 **Topic-Id:** C **Subtopic-Id:** MSL

Question Description: What will be the output of following program ?

```
main() {  
int x,y = 10;  
x = y * NULL;  
printf("%d",x);  
}
```

Option1: error

Option2: 0

Option3: garbage value

Option4: 10

Correct answer: 0

Hint-1: NULL is a macro defined in stdlib.h

Hint-3: Macro is just replaced by its value at compile time

Hint-2: NULL is defined as zero

Comment(optional): ...

Limitations of Our ITS

Our ITS has some limitation as follows.

- will not provide the support to collaborative activities like forum, chat etc.
- will support only multiple choice questions.
- does not consider the time taken by student to answer the question.
- doesn't have the support for multimedia content like video lectures etc.

Conclusions

- Limited to teach any subject with the help of multiple choice questions (MCQs) only. But the scope of our ITS can be extended in future.
- Provide the flexibility to the instructor to teach with the strategy of his interest.
- Provide the functionality to the instructor to track the progress of each student.
- Teach the student with strategy which is best suitable for him. This decision is taken by the ITS according to the learning history of students.

Thank You

References

- 1 Yelland, Nicola, and Masters, Jennifer (2007). Rethinking scaffolding in the information age. *Computers and Education*, 48, 362-382.
- 2 Bodrova, E., & Leong, D. J. (1998). Scaffolding emergent writing in the zone of proximal development. *Literacy Teaching and Learning*, 3(2), 1-18.
- 3 Yogendra Pals APS report: Intelligent Tutoring System to teach programming to bilingual students, IIT Bombay
- 4 B. Cheung, L. Hui, J. Zhang and S.M. Yiu, SmartTutor: An intelligent tutoring system in web-based adult education, at *The Journal of Systems and Software* 68 (2003)
- 5 Jamie McKenzie, author of *Beyond Technology: Questioning, Research and the information Literate School Community*
- 6 Beth Lewis, *Scaffolding Instruction* 2006

ITS Framework: Time sequence diagram

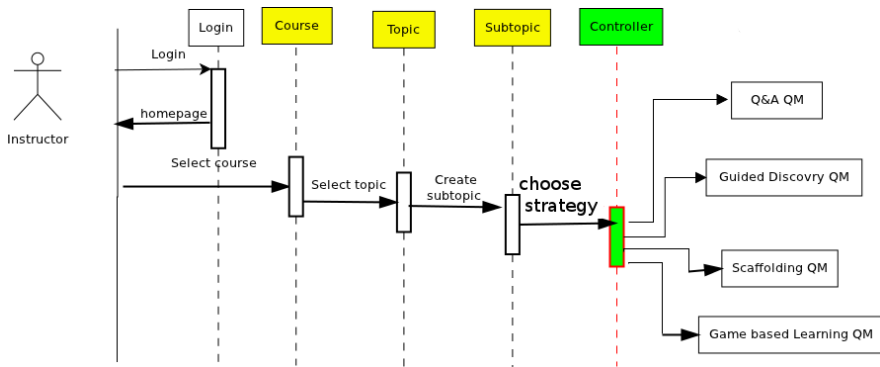


Figure: Time sequence diagram for instructor

ITS Framework: Time sequence diagram

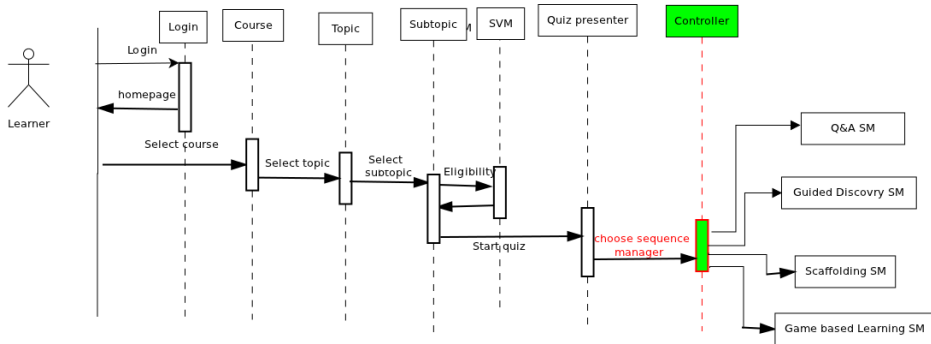


Figure: Time sequence diagram for learner

Challenges

- Finding an appropriate course structure which supports more than one teaching strategy.
- Finding the teaching strategies which can be compatible with the structure.
- Developing an algorithm for providing questions to learner according to his learning experience with strategies.
- Finding the common and uncommon modules between these strategy. According to this make a generalized architecture.
- And main challenge was DATABASE integration.

Future Work

- Implementing modules for subjective questions
- Collecting material for teaching
- Implementing Response Time Theory
- Adding More teaching strategies
- Providing Collaborative learning
- Increase competitiveness

- Simple but careful design questionnaire
- Relies on observation and decision-making skill
- Immediate and specific feedback, both corrective feedback and positive reinforcement, is provided with each student response.
- scaffolding Reduces uncertainty, surprise, and disappointment
- make the video of students actions.
- School of Professional and Continuing Education
- Most system Neglect personalization in the learning environment developed without paying enough attention on concrete educational theories (Mayes, 2000).

- The secure e-course exchange (eCX) provides a secure layer for protecting the copyrighted materials.
- The communication and searching infrastructure (CSI) provides efficient communication channels among admin-teacher=student
- The content engineering system (CES) is mainly used by instructors to create online course materials and launch online courses.
- The e-institute is the administration center of the platform. Finally, the e-learning platform is where students will interact for studying and downloading relevant learning materials.
- content structure is core part. all chapters are linked and give weight to each chapter or node.
- School of Professional and Continuing Education
- Most system Neglect personalization in the learning environment
- developed without paying enough attention on concrete educational theories (Mayes, 2000).

