Modeling Effective Interactive Technology for Education

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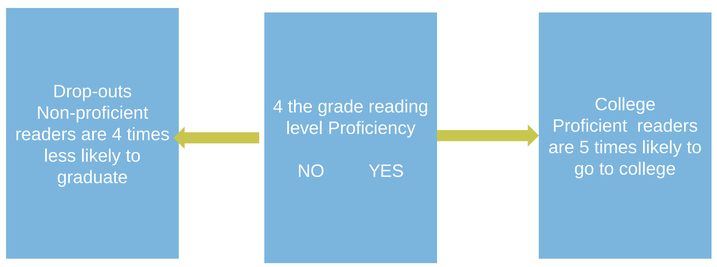
Abstract

Literacy development is a critical life skill necessary for an individual's socio-economic growth. Yet, 66% of US fourth graders cannot read at grade level, leaving that group 4 times more at risk of dropping out before finishing high school. Model Driven Architecture (MDA) can be used to address problem/solution sets, with specific constraints independent of the systems that carry out the instantiation of the design. Assistive technologies that build associations between text and speech, can improve reading comprehension, and increase vocabulary levels in children and young adults. From a Structural perspective, research centers around using MDA to implement platform specific applications, and processes of fine grain audio segmentation. Behavioral research will look at learning with regards to early literacy development, and the effects that highlighting text while the words are spoken has on word association, reading comprehension, and overall reading level.

Background

66% of US 4th graders cannot read at grade level, 16% of the same group will drop out before graduating high school, 4 times the drop-out rate of proficient 4h grade readers.



Value Proposition

Develop assistive educational tools that:

- Give parents and educators highly interactive media rich content
- Stimulate children's curiosity and engage them participatory learning
- Naturally support the best known process of early literacy development

Methods

Model Driven Architecture (MDE) can be used to address problem/solution sets in literacy development, with distinct parameters independent of the systems that carry out the instantiation of the design. Specifically, MDA can model assistive technologies that build associations between text and speech, thus improving reading comprehension, and increasing vocabulary levels of children and young adults

Model-driven approach

Three core ideas:

- Models Represent Systems
- Models conform to Metamodels
- Models may be transformed into other models

Four Levels of Abstraction:

- M_3 Meta Meta Model: the alphabet / symbols (abstract tools
- M_2 Meta model: Role Based Modeling Language (models)
- M_1 UML Diagrams: Class, Sequence, State diagrams (implementation)
- M_0 Object Diagrams, Running code (real world instantiation)

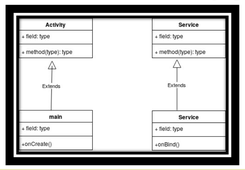
Benefits of MDE

- UML-based modeling in order to facilitate and accelerate the development
- Reduce the gap between the problem space and the implementation through systematic model transformation
- Reduce the time spent on software production by 70%

MDA for BookSprout

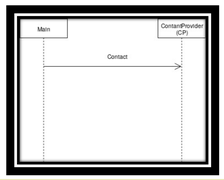
Structural View:

- Activity and Service are special components used to define structure
- The Activity and Service classes have several default methods that are often customized, standard code can by generated

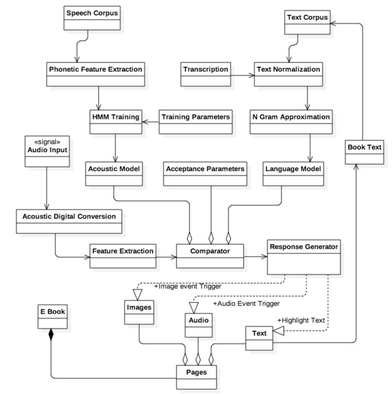


Behavioral View:

- When an application class can request some data or some Service from another component
- Here a representation for a data request to the Content Provider



UML for BookSprout



Findings & Conclusions

Findings:

- Assistive educational technologies tend to improve reading proficiency
- Those with learning disabilities such as autism or downs syndrome tend to have greater gains in reading improvement
- Those with limited access to assistive technology have minimal gains

Conclusions:

- Reading aloud with a child, or co-reading, is still the best way of teaching a child to read
- Augmenting co-reading with assistive technology, especially Natural Language Processing and Speech Recognition improves text-speech association, word recall, and overall reading proficiency
- Media rich content helps students scaffold information so they might better internalize it

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