Integrating the outer loop: Validated tutors for portable courses and competencies

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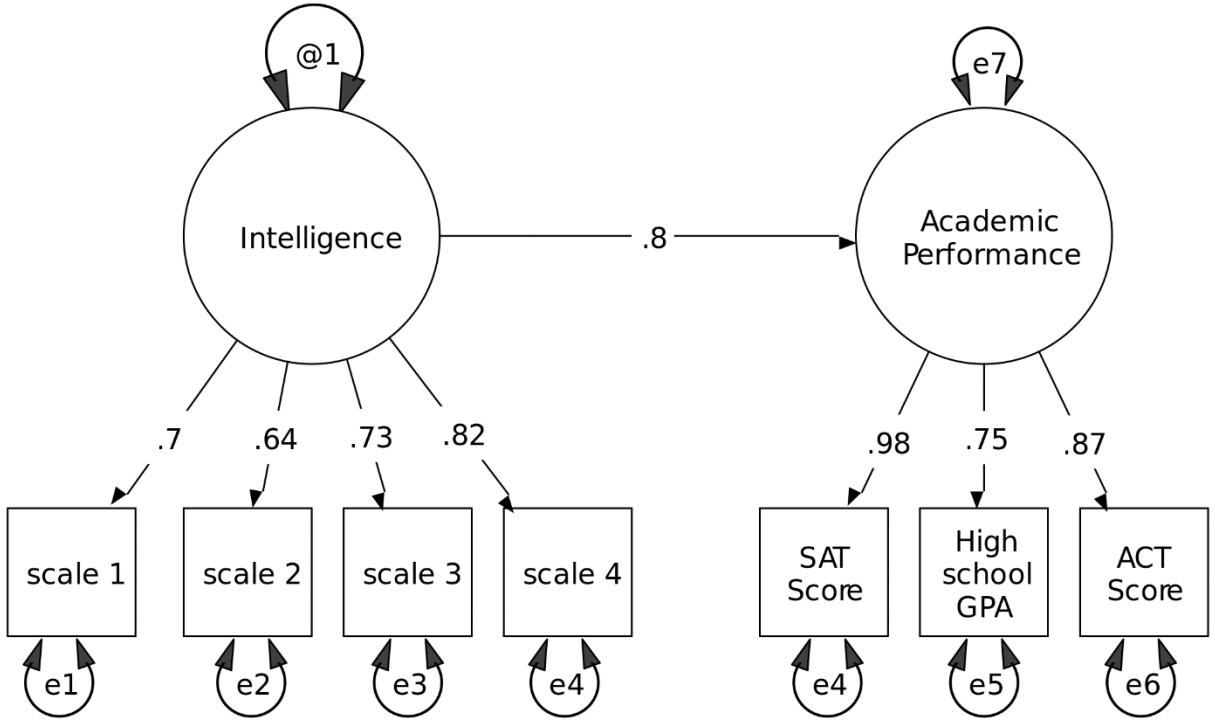
Overview

- The GIFT Structural Equation Modeling (SEM) module is the first validation module to be added to GIFT.
- Incorporating additional validation approach in GIFT could assist instructors and content creators to validate courses by providing outcome based feedback.
- With validated courses, GIFT can provide reliable instruction to next generation Service Oriented Architectures (SOAs).

Part 1: GIFT SEM

Structural Equation Modeling: Overview

SEM is a statistical technique designed to provide causal inference and validation.



Structural Equation Modeling: Overview

SEM measures:

Impacts of latent concepts on student learning

Importance of individual factors in outcomes

Causality of sequential events

Structural Equation Modeling: Overview

GIFT SEM allows for:

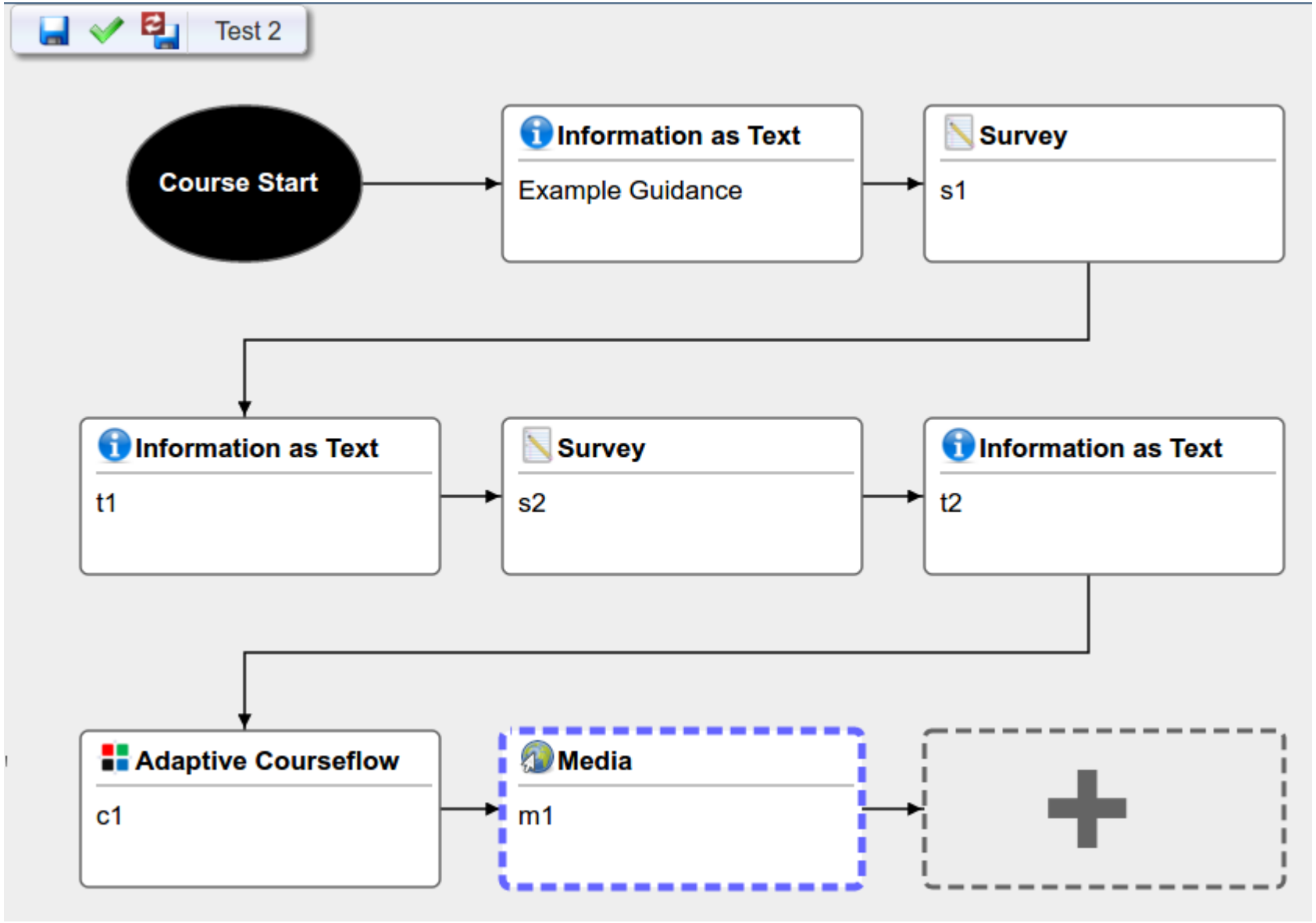
Causal inference about the structure of the concept map for a course

Validation of a concept model

Investigation of other potential concept models

Analysis of the order and learning pathways taken by students

How does SEM work in GIFT



Steps:

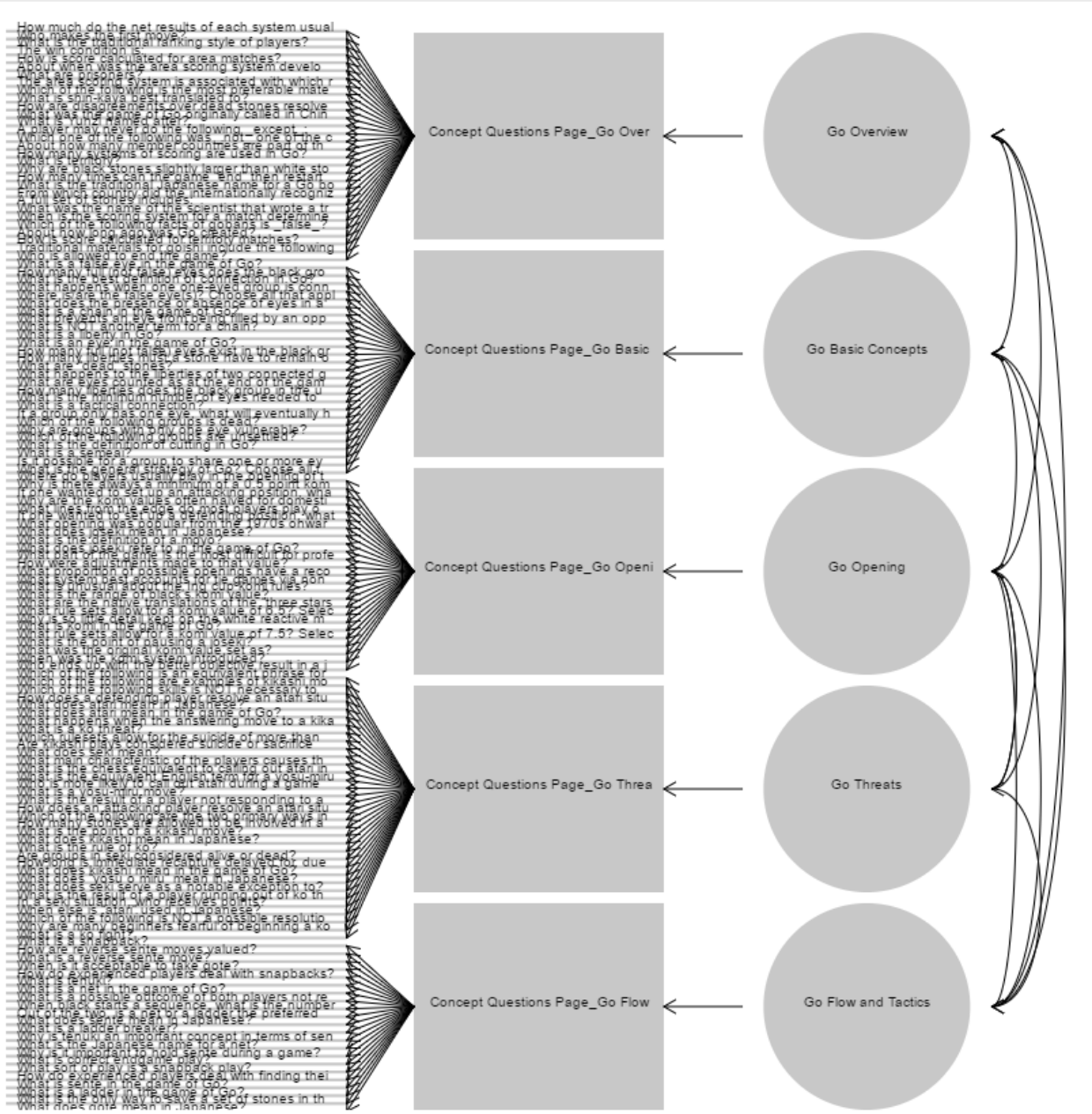
1. Prototype course.
2. Deploy Prototype course.
3. Gather data.
4. Use data to create SEM model.
5. Validate sequence of courseflow using SEM.
6. Explore alternate sequencing using SEM.
7. Deploy Updated course.
8. Iterate.

How does SEM work in GIFT

Process:

1. Logfiles are analyzed for:
    1. Student data.
    2. Indicators tied to concepts.
    3. Sequence of progression through concepts.
2. Model is automatically constructed.
    1. Shows progression sequence.
    2. Aggregates questions into surveys.
    3. Populates model with data.

GO Course



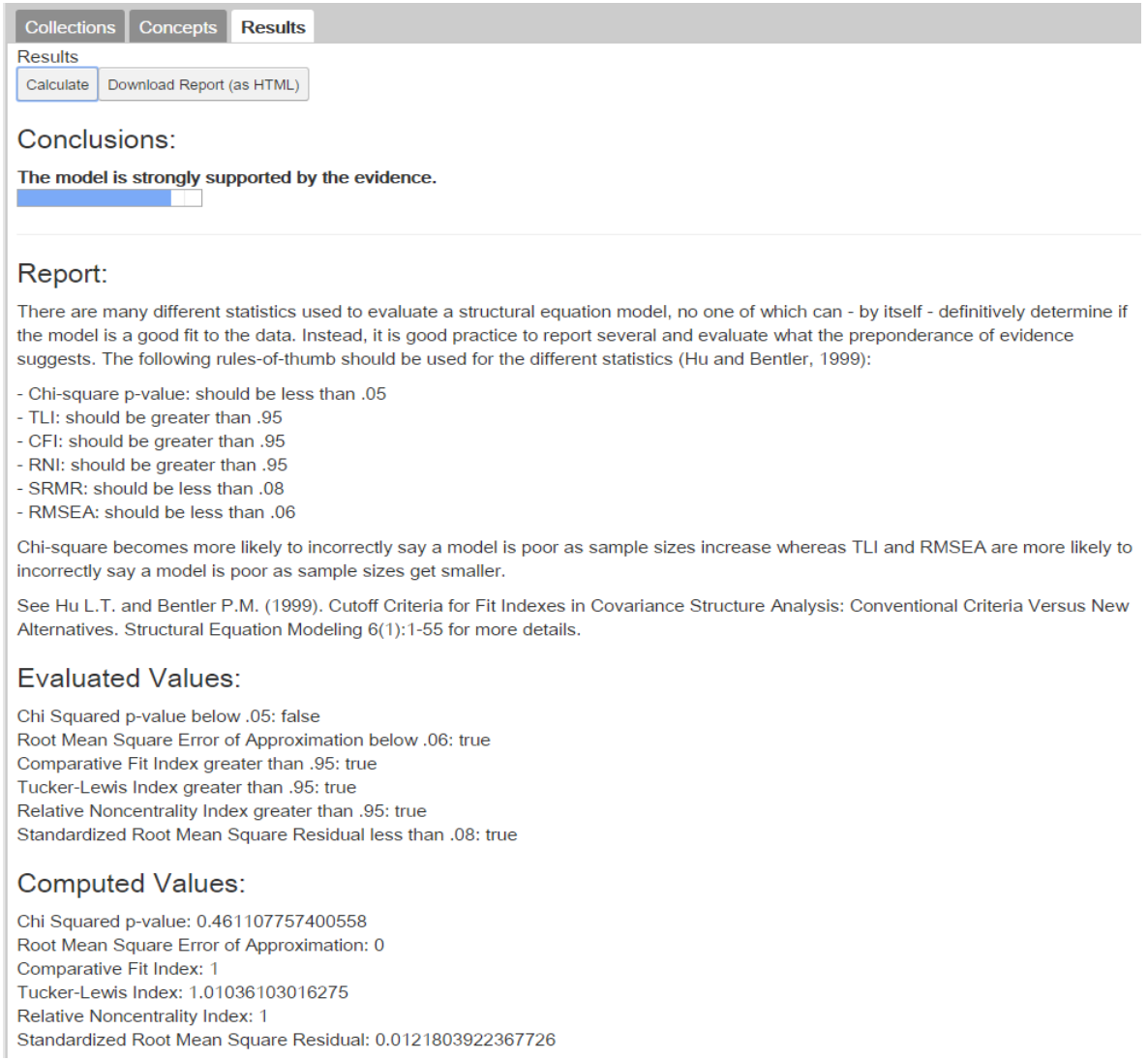
GIFT SEM: What now?

Based on the technical output, we know:

- The concept model for the course is supported by student results.
- The ordering of the concepts is aligned with the assessments.

In the case where the concept model is poorly supported by student outcomes:

- Revisit the course design and test out alternate concept mappings.
- Repeat until a supported concept map is discovered.



Part 2: GIFT in SOAs

Service Oriented Architectures

Service Oriented Architectures (SOAs)

- Large, distributed collections of software that fulfill the individual roles necessary to deliver a complete user experience (Papazoglou, 2003).
- Relatively new to the domain of education (Lavendelis, 2012).
- Common components include user management, content repositories and more.

- GIFT could be a component of SOAs and incorporate validated tutors into them

GIFT can enable validated teaching and learning functionality in many SOAs.

- Lavendelis, E. (2012). Distributed intelligent tutoring system architectures (pp. 241-266). INTECH Open Access Publisher.
- Papazoglou, M. P. (2003, December). Service-oriented computing: Concepts, characteristics and directions. In Web Information Systems Engineering, 2003. WISE 2003. Proceedings of the Fourth International Conference on (pp. 3-12). IEEE.

Validation

- Allows for iterative development and improvement of tutors.
- Generates trust when sharing tutors, best practices, and concept frameworks.
- Validated tutors become benchmark learning resources.
- Centralizes GIFT as a learning system that uses student results to improve future tutors.

Validation in GIFT allows authors to iteratively improve tutors using student data.

Future: Potential Elements for GIFT Validation

GIFT SEM is the first GIFT validation module. Steps forward could involve GIFT:

- Validating pedagogy
- Identifying optimal modes for training
  - Tutor, live, VR, mixed reality, etc.
- Integrating into synthetic training environments
  - Underlying concept models
  - Course ordering
- Exploring alternate concept models
- Testing alternate concept flow
- Etc.

GIFT Evaluation and Interpretation Model

The GIFT Evaluation/Interpretation model is designed to manage data extraction, interpretation, and formatting for use in multiple evaluation modules.

- Currently:
  - Implemented as part of GIFT SEM.
  - Reads GIFT logs.
  - Provides an internal data model for GIFT modules to perform evaluation.

Data transportability is key to integrating GIFT into SOAs.

Part 3: Expanding ADDIE

Overview

The ADDIE process is one of the most recognized instructional design methodologies.

For GIFT to provide validated tutors and training to a SOA ecosystem, each of the ADDIE steps can be expanded to accommodate other relevant portions of the SOA ecosystem.

We discuss each step in the ADDIE (analyze, design, develop, implement, evaluate) process and outline how it interacts with portions of the SOA and GIFT.

ADDIE

- A - Analyze
- D - Design
- D - Develop
- I - Implementation
- E - Evaluation

Analyze

In the first step of the ADDIE process, a designer analyzes the domain of instruction with the assistance of a subject matter expert (SME). To maximize interoperability and compatibility, a list of concepts is constructed (or imported) based on existing knowledge of the domain.

Design

The designer identifies, acquires, and conceives new content. This content can be selected from other portions of the SOA that are focused on content creation, curation, storage, and alignment.

Develop

The designer imports content from throughout the SOA and constructs the GIFT tutor. In this step, the designer ensures correct reporting data is available to GIFT and that the tutor is correctly instrumented with all necessary reporting required by the SOA.

Implementation

The designer implements the tutor. Values for concepts used in GIFT may be acquired from local learner data, but may also be loaded from other portions of the SOA.

Unlike traditional ADDIE, there is constant feedback between the implementation of the tutor, GIFT, and the SOA.

Evaluation

Validated domain models, and other future validated content, will allow GIFT to quickly repurpose, update, and reuse successful portions of content, as is normally done in ADDIE. It will also allow the evaluator to evaluate data in the context of the entire SOA, informing both the effectiveness of GIFT tutors and the quality of data and resources coming from other parts of the SOA.

Part 4: Conclusions

Conclusions

- There is potential for an iterative ADDIE process within GIFT that allows GIFT to validate pedagogy, tutors, and domain models individually or as part of a SOA ecosystem.
- GIFT can add incredible value to a SOA ecosystem by providing tutors, data, and evaluation.
- GIFT SEM is the first example of a GIFT validation module that adds this functionality to GIFT.

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Questions?