The GIFT Authoring Experience: 2018 Update

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INTRODUCTION

Intelligent tutoring systems (ITSs) are computer-based adaptive instructional systems (AISs) "that guide learning experiences by tailoring instruction and recommendations based on the goals, needs, and preferences of each learner in the context of domain learning objectives" (Sottilare & Brawner, 2018, p. 25). In general, the more adaptive an ITS is, "the more content it needs to support tailoring and personalization of instruction – which also leads to longer development times and higher costs" (Sottilare & Fletcher, 2018, p. 1-2).

The three primary barriers to the adoption of ITSs are 1) their cost, 2) the specialized skills required to build them, and 3) their lack of standardization and thereby lack of reusability. All of these factors influence cost and therefore reduce the return-on-investment. Their cost is largely driven by the usability (or lack of usability) of authoring tools and the high degree of skill in instructional design, domain knowledge, and computer programming required to construct and ITS that can function without human intervention.

A major goal of the authoring tools for the Generalized Intelligent Framework for Tutoring (GIFT;) is to ease the development of ITSs in a variety of domains: cognitive, affective, psychomotor and social (Sottilare, Goldberg, Brawner, & Holden, 2012). With this goal in mind, the US Army Research Laboratory (ARL) focused their authoring research and development in 2017-2018 in four primary areas:

- Enhance the user interface to make it easier to develop ITSs
- Enhance user support for authoring tasks
- Expand authoring support for new capabilities
- Identifying opportunities for AIS standards

ENHANCE THE GIFT USER INTERFACE

In 2017, the cloud-based GIFT authoring tool was completely redesigned to allow users, without Instructional Systems Design (ISD) or computer programming expertise, to develop an intelligent tutor. As described in (Ososky, 2017), the redesigned authoring tools provide a graphical view of the adaptive course that is being created or modified. Figure 1 shows the current authoring tool which is made up of three frames. The one on the left shows the Course Properties (top), types of *Course Objects* that the author may choose (middle), and any media that the user has uploaded for use in the course (bottom). The center frame is the *Visual Flow Editor* and shows the flow of the course and allows the author to drag and drop various types of course objects onto the course flow diagram and then configure them to the specific domain of instruction. On the right side of the display is the *Editing Frame* that allows the user to edit/configure the selected course object. The focus of this paper is on new approaches to support GIFT authors to improve the user experience (UX), as well as authoring tool changes resulting from research conducted over the past year to add new capabilities to GIFT.
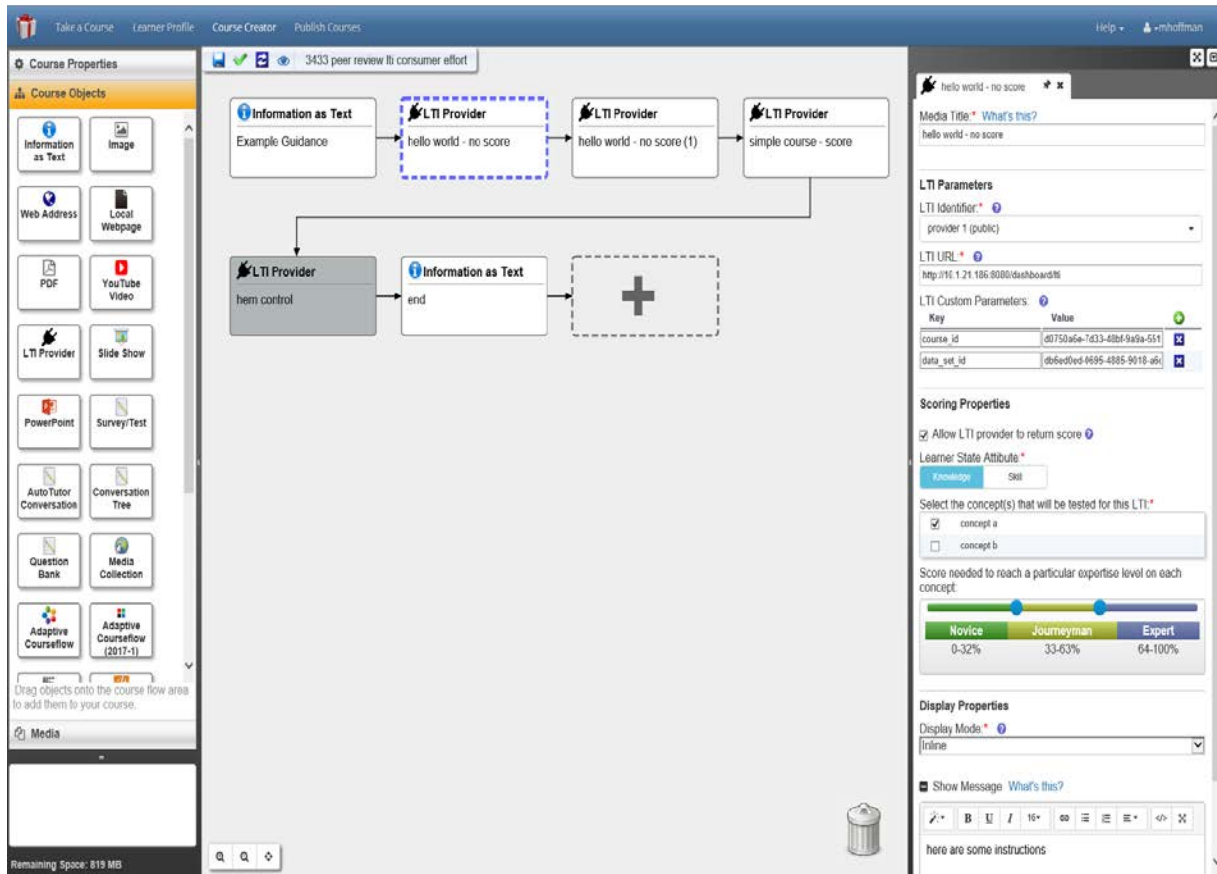
Figure 1. GIFT Authoring Tool

ENHANCE GIFT USER SUPPORT

In January 2017, a team of researchers from ARL went to Fort Benning, Georgia to gather feedback on the newly re-designed GIFT Authoring Tool from potential military users. While the collected data showed that there was some improvement over previous versions of the authoring tool, there was still much work to be done. To provide additional support for the GIFT authors, ARL commissioned the development of a *GIFT Summer Camp* to provide detailed instruction for potential ITS authors, the development of several *GIFT instructional videos*, and the production of exemplar tutors to illustrate how GIFT tutors are constructed/configured.

GIFT Summer Camp

The ultimate goal for GIFT is that a domain Subject Matter Expert (SME) should be able to use the GIFT authoring tools to develop adaptive instruction (e.g., training course) without any additional help from instructional systems designers, computer programmers, etc. While we have come very close to reaching that goal, some users may still need some help in using the authoring tools. As a result, we developed a two day course, *GIFT Summer Camp*, that teaches participants how to use the GIFT authoring tools to create an adaptive training course. Learning material was provided to the participants to use in making an adaptive training course on human anatomy using GIFT. Participant feedback was collected and may be used to provide a commercial offering of the course in the future.

GIFT Instructional Videos

Since not everyone will be able to attend a GIFT Summer Camp session, we have also generated several educational youtube videos that demonstrate how to use the various features of the GIFT authoring tools (https://www.youtube.com/watch?v=nGywC-jf0Mk). Table 1 provides a current list of the videos. More instructional videos will be added in the future to guide GIFT users.

Table 1 – List of Available Gift Instructional Videos

About GIFT	Difference between types of surveys
GIFT Authoring Process	Import Tutor
Cloud vs. Downloadable GIFT	Copy Tutor
Adding a Survey	Metadata Tagging
Importing Media	Course Concepts
Where to find help	Linking to a simulation
Computer-based Training vs Intelligent Tutors	Question bank
GIFTSym and Community	Powerpoint vs Slideshow
Course Objects Overview	Case Study – Excavator Simulator
Export Tutor	Making an experiment

Since new functionality is continually being added to GIFT, the use of instructional videos is a quick and effective method to support GIFT authors in developing tutors. The videos are made in three phases: the script generation, the video demonstration, and the voice/video integration. The script is created and reviewed by the GIFT team to insure accuracy. We then have someone perform the specific function using GIFT while video capture software records the video from the computer screen. Once that is accomplished, the video is played back while the narration is captured. After final quality assurance and security review, the video is posted on youtube (Figure 2).
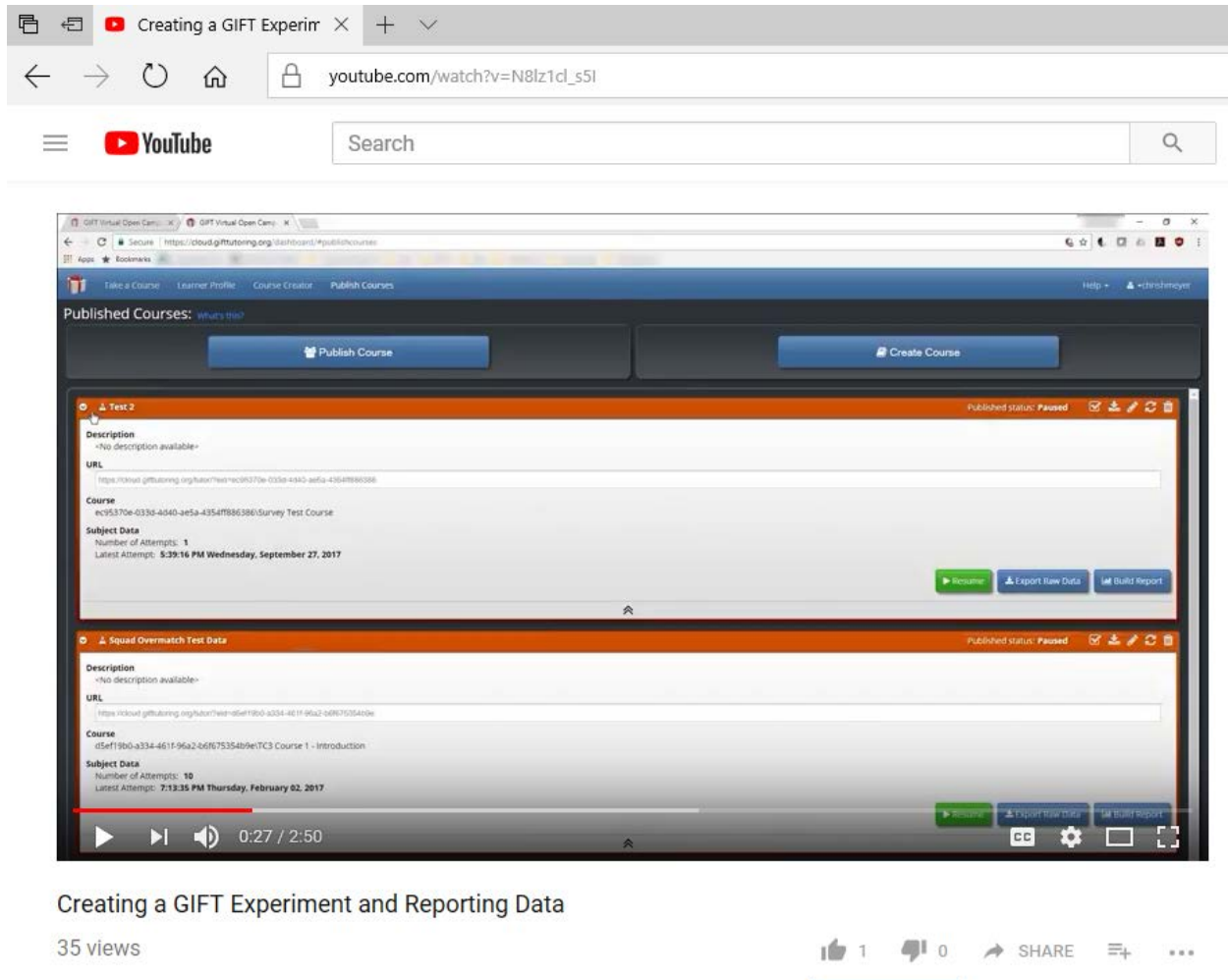
Figure 2. GIFT Instructional Video on YouTube

Exemplar ITSs

To improve usability, we provided a set of public tutors that authors can use a models or exemplar tutors to guide development of their own tutors. While the exemplar tutors are not full ITSs, they do illustrate how authors are using GIFT to develop tutors in a variety of domains. Starting in FY18, ARL will be developing three additional tutors using the GIFT authoring tools to train knowledge and skills within three military contexts – land navigation, intelligence reporting, and visual signaling. The tutors will be authored to include multimedia components and will incorporate instructional system design principles for adaptive learning environments, to include passive, didactic training as well as interactive practice and rehearsal in prototypical scenarios. The GIFT-based tutors will incorporate external training applications like Unity and Virtual Battle Space (VBS3), and Leap Motion technology to incorporate real-time performance assessments to drive adaptive instruction.

Throughout the development of the tutors, GIFT will be continually assessed and usability issues will be identified. The tutor development process will also be thoroughly documented. The project will provide a systematic evaluation of GIFT usability, with recommendations for areas of improvement in user interface design and user experience. The research will result in high quality, sharable tutor exemplars highlighting the "art of the possible" in developing ITSs with GIFT. The documented process to developing tutors will

benefit other authors in the GIFT community, demonstrating GIFT's utility for creating effective adaptive training.

AUTHORING SUPPORT FOR NEW CAPABILITIES

There has been a lot of new functionality added to GIFT over the past year. Most of these capabilities have required changes to the GIFT authoring tools. The resulting new capabilities are discussed below.

Learning Tools Interoperability (LTI)

Last year, the LTI protocol (https://imsglobal.org/activity/learning-tools-interoperability) was partially implemented in GIFT to support ongoing research in the use of Massively Open Online Courses (MOOCs; Aleven et al., 2017). MOOCs are typically made up of recorded video lectures and outside learning activities. The main problem with MOOCs, however, is the very high drop-out rate compared to other on-line learning environments. The goal for this project is to provide additional support to the leaners through the use of ITSs, to include CTAT and GIFT, to support the Big Data in Education MOOC. The GIFT authoring tools were modified to support LTI version 1.0 as an LTI provider. As a result, GIFT could send/provide learner performance data from these activities to the LTI compliant Learning Management System (LMS) including edX, Canvas, and Blackboard. This year, the rest of the LTI has been implemented and now makes GIFT an LTI consumer. This new capability allows GIFT to receive data from other educational systems. For example, GIFT can now use LTI to receive learner performance data from a CTAT tutor. This new capability allows GIFT to control the outer loop of a course (e.g., macro-adaptation) while the CTAT tutor supports the inner loop (micro-adaptation..

Sketching Activities

Over the past year, the Army Research Laboratory (ARL) and Northwestern University have been exploring sketching technologies to support spatial learning, as part of on-going cooperative research in adaptive training technologies (Long, Forbus, Hinrichs, & Hill, 2018). Cogsketch and its associated Sketch Worksheets were designed to be general-purpose and use artificial intelligence to provide feedback to the learner performing sketching assignments (Figure 3). Cogsketch also has its own authoring environment for domain experts and instructors, to enable them to create new worksheets. The goal of this on-going cooperative research is to leverage Cogsketch to support the use of a sketching modality in GIFT as a new type of instructional media.
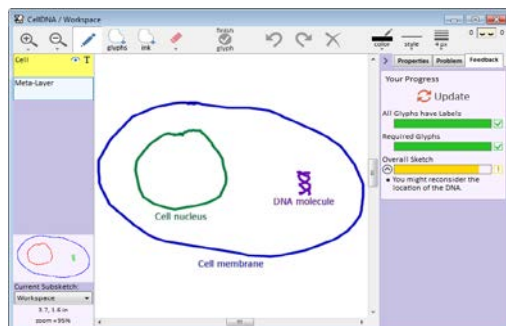

Figure 3. Cogsketch Authoring Tool

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

From the user feedback we received from GIFT users at Ft Benning, we realize that the GIFT authoring tools still have room for improvement. In the near term, we have provided additional support to authors in the form of instructional videos, on-site training classes (summer camp), and exemplar tutors. Future research should include a study to determine the effectiveness of the instructional videos, as these are fairly easy to make and provide just in time training for users that need support. In addition, we will continue to gather user feedback to improve usability of the GIFT authoring tools.

ACKNOWLEDGEMENTS

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