

A Personalized GIFT: Recommendations for Authoring Personalization in the Generalized Intelligent Framework for Tutoring

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Abstract. Personalization of learning content can have a positive impact on learning in a computer based environment. Personalization can occur in a number of different ways, such as including an individual's name or entered content throughout the learning materials, or selecting examples based on self-reported preferences. The Generalized Intelligent Framework for Tutoring (GIFT) is an open-source, domain independent intelligent tutoring system framework. GIFT includes a number of different authoring tools (e.g., GIFT Authoring Tool, Survey Authoring System) that can be used to generate adaptive courses. In its current form, GIFT does not have specific mechanisms to support personalization of materials to the individual user based on pre-entered preferences. The current paper describes ways that personalization research has previously been conducted with GIFT. The paper additionally provides recommendations on new features that could be added to GIFT's authoring tools in order to support personalizing learning materials, guidance, and surveys that are provided to the learner.

Personalization is an instructional strategy that has been shown to have a positive impact on an individual's learning. Depending on the area of research, the term personalization can have different meanings. In some cases, personalization refers to the ability for an adaptive tutor to store information about an individual's skill level or current performance and adapt the level of difficulty of future materials accordingly. However, for the purposes of the current paper, the type of personalization that is being discussed is defined as including information that is important or interesting to an individual learner within the learning materials that they are presented with. Research into this type of personalization has roots in cognitive psychology research in regard to the self-reference effect, as well as in educational psychology research in the area of context personalization [1, 2]. Research into the self-reference effect has consistently shown that if an individual links material to themselves it is easier for them to recall than if it is linked to something unrelated to them [3]. Similarly, there have been positive effects that have been found from linking information to people that the learner knows, or information that is important to them. This concept has been additionally applied in research that personalizes the context of the materials to be learned

to topics that are of interest to the individual. There has been research that suggests that this tailoring of topics can have a positive impact on the retention of the material [4,5].

1 Personalization as an Instructional Strategy

The impact of personalization as an instructional strategy has been studied in both the classroom [4,5,6] and computer-based learning environments [7,8]. While these studies have found fairly consistent results, the strategies they used for collection of information from the students has varied. Further, the way that the materials were personalized in response to the student provided information has also differed. In some cases, materials were adjusted to the most popular items provided by students in the class, as opposed to being unique to the individual [6]. In other cases, personalization and utilization of the self-reference effect was done by phrasing materials generally to include the word “you” and make reference to the self, with the goal of prompting the individual to think of themselves in relationship to the material to be learned [8]. Other studies have included the student-entered information directly in the individual student’s learning material and questions to examine its impact on the learning outcomes [7], [9]. The mechanism by which the benefits are provided has not been entirely agreed upon in the literature. It has been hypothesized that personalization takes advantage of the self-reference effect, and the links to the self [8,9]. Consistent with this hypothesis, this self-reference and interest is lowering the cognitive workload needed to interpret the information, making it easier and more efficient for the individual to learn. Additionally, it has been hypothesized that there may be affect-related benefits to personalization that result from the system taking an interest in the individual, and that the student feels that his or her preferences have been acknowledged [10].

It has been found that there are advantages to changing the context of learned materials to be consistent with individual college majors and that there are better learning outcomes when the examples match the major. Specifically, when nursing students were taught using medical examples (as opposed to education examples) they performed better on achievement measures; conversely, when education students were taught using education examples they performed better on the same tasks [4,5]. In regard to computer adaptation, Anand and Ross [7] designed a computer program which asked individuals questions such as their names, the names of their friends, their favorite foods, and favorite interests. After entering this information into the program it modified the specific learning materials and questions for the students’ interactions. They found that the individuals who received the personalized information performed better than those who did not.

Recent research, has examined the role of personalization in adaptive tutoring systems. Carnegie Learning’s MATHia software has begun to examine the impact of providing questions to students that were personalized based on their interest selec-

tions [10]. Research has also suggested that by adapting the contexts of math instruction in adaptive systems there are positive learning outcomes [2].

In many studies of personalization, benefits have not been found in all types of assessments that have been given to students. Evaluations regarding a direct interpretation of the learned material, or simple multiple choice questions may not always yield significant differences between personalized and non-personalized instruction. However, it has been consistently found that personalization provides benefits over non-personalization in regard to evaluating transfer performance [2], [8]. This is particularly important, as it shows that personalization is leading to a deeper understanding of the material by the individual student which results in being able to apply it in new situations. This deeper learning is beneficial as it leads to long term gains and understanding in both similar domains and related tasks [11].

2 The Generalized Intelligent Framework for Tutoring (GIFT) and personalization

The Generalized Intelligent Framework for Tutoring (GIFT) has been utilized to conduct research into the impact of name personalization on learning in a computer-based environment [9], [12]. GIFT is an open-source domain-independent intelligent tutoring system (ITS) framework [13]. It allows individuals to create their own ITSs, which can include customized surveys, and integration with training applications such as PowerPoint, Virtual Battlespace, or TC3 Sim, which can display interactive materials. GIFT is very useful for different types of users including students, authors/instructors who are designing ITSs, and researchers who are conducting studies. There are several authoring tools available in the GIFT system to support the creation of courses. Among the relevant tools for experimentation are the Survey Authoring System (SAS), Course Authoring Tool (CAT), Domain Knowledge File Authoring Tool (DAT), and GIFT Authoring Tool (GAT). There are additional tools which allow for further adaptation and options that can be selected when designing experiments or building an ITS. The tools can be accessed by GIFT authors in the control panel interface, which can be seen in Figure 1.

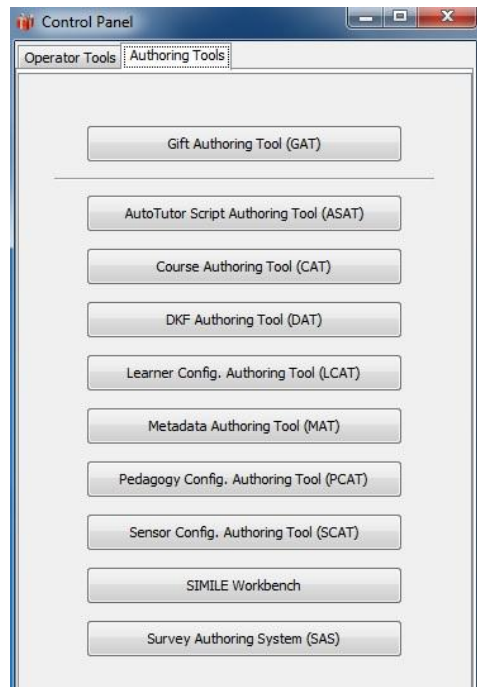


Fig. 1. GIFT's Authoring Tools Control Panel (version 2014-3X)

In the current configuration of tools, there is the potential to personalize material to the individual user, however much of that personalization is required to be programmed separately into a training application (e.g., PowerPoint). Included in this paper are recommendations for new functionalities or additions that can be made to the current tools which would open up the possibility of personalization. These changes can give instructors and researchers options to provide personalized materials within the adaptive tutor.

2.1 Personalization research conducted with GIFT

In the personalization study conducted with GIFT [9], [12], the impact of using different names on tutorial retention and transfer performance was examined. In the first, or self-reference condition, the participant entered his or her own name and the names of friends. This condition was designed to encourage the individual to relate the learned information to themselves. In the second, or popular culture condition, the names of characters from the *Harry Potter* book series were included in the learning materials to encourage the learner to link the familiar series to the material, which could potentially make the learned information easier to retrieve in a similar way as self-reference. Finally, in a baseline/generic condition, names that were not expected to have meaning to the individuals were included. These names were included as part of the materials that individuals were tutored with as they engaged in a computer-

based logic grid puzzle tutorial, which teaches the skill of deductive reasoning. Logic grid puzzles present the learner with a vignette, a series of clues, and a grid. Using the information provided, the learner needs to use both the process of elimination and the clues to determine specific answers/items that go together. The logic grid puzzle tutorial taught learners to successfully complete the puzzles. During the tutorial the names were personalized in the vignette, clues, and grid. An example of the name personalization can be seen in Figure 2 and Figure 3. Figure 2 demonstrates the popular culture condition, and Figure 3 demonstrates the baseline/generic condition. Note the differences in the names present throughout the clues and the grid.

Either/Or Clue:

Clue 4) Harry's baked good was either the one with green sprinkles or the cupcake.

This is an Either/Or Clue.

This type of clue may be useful to review after working through the other clues.

Since we already know that the cupcake does not have green sprinkles, that means that Harry ordered the cupcake.

Enter an O on the grid to represent this relationship.

Remember to also add three Xs for the information you have now ruled out.

Click on your selection:

You have selected O

Key:
X = False
O = True

		Baked Good			Sprinkles Color		
		Brownie	Cookie	Cupcake	Green	Purple	Yellow
Name	Harry	<input type="checkbox"/>	X	<input type="checkbox"/>	X	X	O
	Ron	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	O	X	X
	Hermione	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	X	O	X
	Green	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Purple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Yellow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sprinkles Color							

Fig. 2. Screenshot of the Logic Puzzle Tutorial's popular culture condition's personalization.

Either/Or Clue:

Clue 4) Colby's baked good was either the one with green sprinkles or the cupcake.

This is an Either/Or Clue.

This type of clue may be useful to review after working through the other clues.

Since we already know that the cupcake does not have green sprinkles, that means that Colby ordered the cupcake.

Enter an O on the grid to represent this relationship.

Remember to also add three Xs for the information you have now ruled out.

Click on your selection:
 X O
 You have selected O

Key:
 X = False
 O = True

		Baked Good			Sprinkles Color		
		Brownie	Cookie	Cupcake	Green	Purple	Yellow
Name	Colby		X		X	X	O
	Russell				O	X	X
	Denise				X	O	X
	Green		X				
	Purple						
	Yellow						

Fig. 3. Screenshot of the Logic Puzzle Tutorial's baseline/generic condition's personalization. Note the difference in the names present in the puzzle and clues in the two versions.

An example of the Logic Puzzle Tutorial baseline condition can be found in the downloadable versions of GIFT, which are available from www.gifttutoring.org. The impact of these materials on student information retention, ability to apply learned knowledge, and ability to transfer performance to a more difficult puzzle were examined.

The tutorial itself was developed in PowerPoint using Visual Basic for Applications (VBA) and the personalization was handled by having participants enter their names into a dialogue box in PowerPoint, which were then stored as a variable in PowerPoint, and inserted into the text of the materials during the tutorial. This entire personalization process was handled in PowerPoint/VBA. While this strategy allowed for personalization research to be conducted with GIFT and could be used in the future to personalize materials based on names or interests, there are features of GIFT that could be further adapted in order to provide more personalization options.

2.2 Recommendations for providing personalization flexibility in GIFT's authoring tools

As of GIFT 2014-3X, there are two ways to login to the GIFT software. An individual can login through their gifttutoring.org website account, or use a created system username (simple login) that is local to their computer. In both cases, the system is storing a name for the individual learner. While this name can later be output in log

files, it could be useful for the author to have the option of using the individual's name within the training course.

The author creates guidance and messages that are displayed to the learner using either the CAT or GAT. Additionally, they create survey questions and surveys that will be displayed to the user using the SAS. In the case of the guidance and messages, authors are provided with a blank text box in which they can enter the desired text that will be displayed. It would be very helpful if the author had the ability to access the variable of the user's name and have it display within the provided text. This could be done in a similar way as would be required within PowerPoint with VBA. For instance the author could type: "Welcome to the Tutorial, [name]", which could then pull in the stored information about the learner's name, and display it when they see the given information screen (e.g., "Welcome to the Tutorial, Harry"). An additional way to allow authors to interact with this feature would be to include a "name" button next to the font size options with the text editor that can be clicked to enter in the name within the text. A similar method could be integrated within the SAS in order to allow the author to include the individual's names in the directions or directly in the questions when they create surveys. This would give GIFT course authors the ability to directly address the student within the materials, or examine the impact of doing so in research experiments.

It would also be beneficial to provide the author the ability to present surveys to the learner to gather information about their interests. Once these surveys are answered the entered information can be stored by GIFT and later brought into authored questions. This would be a similar method as to the name storage, but could allow the author to create open entry textbox questions that will be presented to the learner, with the answers stored in specified variable names. The defined and stored variable names could then be entered into the guidance in the CAT/GAT and questions in the SAS to provide personalized information and questions. For example the question might be, "[name] and Ron were watching their favorite TV show, [tvshow]. The special episode of the show was 65 minutes long instead of 44. How many additional minutes were in the show?" The customized version of this question might display as "Harry and Ron were watching their favorite TV show, Once Upon a Time..." There would also need to be an option for the author to provide a default value in the case that the individual decides to skip the question that would write into the variable.

A personalization tool could be designed that would allow the user to write specific questions that would save to specific variables that will later be able to be read into the text. Additionally, the tool would need to provide the author the ability to define the variable names that are to be saved. Rather than creating a whole new tool, this could potentially become a feature of the current SAS that would allow for the creation of specific personalization based surveys.

While name and specific interest personalization in GIFT would be beneficial, there is also the potential for an author creating a set of similar assessment questions that are edited to be in different contexts. For instance, the learner can be asked if he or she is interested in movies, sports, or music. Based on what the learner selects, a specific question will be provided to them which is tailored toward the topic of the interest area. For instance, in one version of the question the text may be about buying

tickets to a film. In the second version it might be about buying tickets to a baseball game, and in the third version it might be about buying tickets to a concert. This type of personalization may be able to be achieved through edits to the SAS that would allow for linking questions that are similar together and selecting the one that is appropriate for the student's preferences.

3 Conclusion

The above recommendations and ideas would provide more flexibility in authoring personalized content and questions in GIFT. Personalization has been shown to have a positive impact on learning retention, particularly in the case of transfer performance. Additionally, by personalizing material to the interests of an individual it may result in them having more positive feelings toward the tutoring system. It would be beneficial to create a personalization authoring tool in GIFT, or to make edits to GIFT's existing authoring tools that would provide more opportunities to personalize materials. By providing these options to GIFT authors it will allow for future personalization experimentation, and for the design of courses that include name and context personalization.

4 References

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