Program Plan
For

COOPERATIVE AGREEMENT

Period of Performance (Base: 8 Months/Options 1-4: 12 Months each)

Between

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And

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Concerning

Generalized Intelligent Framework for Tutors (GIFT): Collaborative Research Effort between ARL and UM

Program Plan by Period of Performance:

(Base POP: 8 Months)
Phase 1: Theoretical Preparation and First Expert Workshop (Trainee Modeling Techniques)
Estimated POP: May 1, 2012 – December 31, 2012
- **Project 1.1: Theoretical and Technical Preparation.** The Memphis team plans to work with the ARL Team to understand the technical details of GIFT. This initial research effort includes the following: (1) a literature review of intelligent tutoring systems (ITSs), (2) refinement of the formal model of ITS (Section 2.4), and (3) conceptual analysis of the GIFT and AutoTutor frameworks. Specifically, this project will include:
    - Face-to-face meetings with the ARL team. The ARL team will be invited to the University of Memphis campus to work with Memphis researchers to systematically introduce GIFT.
    - The Memphis team working to understand existing GIFT implementations and prototypes.
    - The Memphis team working with the ARL team to examine the existing open-source GIFT framework.
    - The Memphis team providing implementation details of the most updated variations of AutoTutor.
    - Specific general requirements for GIFT prototypes (e.g., open-source requirements, etc.).
    - Production of a design document for the first version of the GIFT prototype.
    - Discussion of key issues and topics that will be covered in the first workshop.
- **Project 1.2: First Expert Workshop on Trainee Modeling Techniques.** The first workshop will focus on trainee modeling techniques. The purpose of the workshop is to collect expert views on theoretical and technological issues centered on trainee modeling. Specifically
    - Logistics that guarantee success and outcomes of this and other expert workshops are outlined in Section 4 of the proposal.
    - The focus of the workshop will be centered on trainee modeling. The initial set of topics will be from Sottilare, Goldberg, and Durlach (2011). More details will be discussed during the first LITE lab and UM meeting.
    - Further exploration of the details of the evaluation method. We expect to have a detailed mathematical modeling specification for equation (2.2).
    - This workshop will also serve as the second meeting between ARL and UM researchers to approve plans (prototype design document, for example) from the initial meeting.

(Option 1 POP: 12 Months)
Phase 2: First Prototype and Second Expert Workshop (Instructional Strategy Selection Techniques)
Estimated POP: January 1, 2013 – December 31, 2013
- **Project 2.1: First GIFT Prototype.** UM researchers plan to produce first GIFT prototype.
    - Technical/logistical details for this and other prototypes are specified in Section 4 of the proposal.
    - The content domain, evaluation population, and expected outcome (for evaluation of success) will be from **Project 1.1.**
    - The first GIFT prototype will be to migrate a selected AutoTutor implementation within the GIFT framework, with the following requirements:
        - It will be fully functional, satisfying ARL GIFT prototype requirements (as a result of Project 1.1).
        - We will incorporate expert suggestions from the first workshop on trainee modeling techniques (from Project 1.2).
    - Delivery contents will be in three different domains.
    - The Memphis team will assist the ARL team in developing a beta-prototype for the second expert workshop on *instructional strategy selection techniques*. The Memphis team will also provide issues and topics to be focused on during the second workshop.
- **Project 2.2: Expert Workshop on Instructional Strategy Selection Techniques.** The main focus of the workshop is to collect expert views on theoretical and technological issues centered on instructional strategy selection techniques. Specifically
    - Logistics that guarantee the success and outcomes of this and other expert workshops are outlined in Section 4 of the proposal.

- o The workshop will also focus on selected adult learning principles (http://psyc.memphis.edu/learning/whatweknow/index.shtml).
- o Examination of the beta-implementation of tutoring modeling from the first GIFT prototype (project 1.2).
- o This workshop will also serve as the third meeting between ARL and UM researchers to evaluate outcomes of the first prototype (Project 1.2) and adjust plans for the second version of the GIFT prototype (due to new theory and new server/delivery technologies).

(Option 2 POP: 12 Months)
Phase 3: Evaluation of the First GIFT Prototype, Create Second GIFT Prototype, and Third Expert Workshop (Authoring Tools and Expert Modeling Techniques)
Estimated POP: January 1, 2014 – December 31, 2014

- **Project 3.1: Evaluation of the First GIFT Prototype.** The third-party independent evaluation team, CREP (http://www.memphis.edu/crep/), will evaluate the produced prototype (Project 2.1)
  - o Details of the proposed evaluation of prototype are outlined in Section 4.4 of the proposal.
  - o The Memphis team will report their findings at the third workshop.
- **Project 3.2: Second GIFT Prototype.** We plan to produce a second GIFT prototype built on the first GIFT prototype (Project 2.1).
  - o Technical/logistical details for this and other prototypes are specified in Section 4 of the proposal.
  - o Content domain, evaluation population, and expected outcomes (for evaluation of success) will be from **Project 1.1** and potential modifications from the second workshop **(Project 2.2)**.
  - o The second GIFT prototype will have the following requirements:
    - ▪ It will be fully functional, satisfying ARL GIFT prototype requirements (as a result of Project 1.1).
    - ▪ It will be an improved version, incorporating new server and delivery technology.
    - ▪ It will incorporate expert suggestions from the second workshop on instructional strategy selection techniques (from Project 2.2).
  - o Delivery contents will be in three different domains.
  - o We will provide a beta-prototype for the third expert workshop on authoring tools and expert modeling techniques and provide the issues and topics that will be focused on during the third workshop.
- **Project 3.3: Expert Workshop on Authoring Tools and Expert Modeling Techniques.** The main focus of the workshop will be to collect expert views on theoretical and technological issues centered on the workshop theme of authoring tools and expert modeling techniques. Specifically
  - o Logistics that guarantee the success and outcome of this and other expert workshops are outlined in Section 4 of the proposal.
  - o We will explore the detailed mathematical models (**Knowledge Representation**) as a function of domains. For example:
    - ▪ What would be the general algebraic structure of the domain knowledge?
    - ▪ What are the relations between the topics?
  - o We will incorporate existing methods of knowledge organizations such as "learning space" that is part of ALEKS mathematics tutoring.
  - o We will explore how to incorporate domain knowledge structure that is already existing, such as concept maps and learning progressions.
  - o This workshop will also serve as the fourth meeting between the ARL team and the Memphis team to evaluate outcome of the second GIFT prototype (Project 2.2) and adjust plans for the third version of the GIFT prototype (due to new theories and new server/delivery technologies).

(Option 3 POP: 12 Months)
Phase 4: Evaluation of the Second GIFT Prototype, Create Third GIFT Prototype.
Estimated POP: January 1, 2015 – December 31, 2015

- **Project 4.1: Evaluation of the Second GIFT Prototype.** The third party independent evaluation team, CREP, will evaluate the produced prototype (Project 3.2).
  - o Details of the evaluation of prototype are outlined in Section 4.4 of the proposal.
  - o We will report CREP's findings to facilitate the creation of the final GIFT prototype.

- **Project 4.2: Third GIFT Prototype.** The Memphis team will assist the ARL team to develop a third GIFT prototype as an extension of the second GIFT prototype (Project 3.3).
  o Technical/logistical details for this and other prototypes are specified in Section 4 of the proposal.
  o The content domain, evaluation population, and expected outcome (for evaluation of success) will be from **Project 1.1** and potential modifications from the third workshop **(Project 3.3)**.
  o The third GIFT prototype will be built upon the second GIFT prototype (Project 3.2) with the following requirements:
    ▪ It will be fully functional, satisfying GIFT prototype requirements (as result of Project 1.1) and additional requirements from the previous workshops (Projects 1.2, 2.2, 3.3).
    ▪ It will be an improved version, incorporating new server and delivery technology.
    ▪ It will incorporate expert suggestions from the third workshop on Authoring tools and expert modeling techniques (from Project 3.3).
  o Delivery contents will be in three different domains.

(Option 4 POP: 12 Months)
Phase 5: Evaluation of the Third GIFT Prototype and Creation of the Final GIFT Prototype.
Estimated POP: January 1, 2016 – December 31, 2016
- **Project 5.1: Evaluation of the Third GIFT Prototype.** The third party independent evaluation team, CREP, will conduct evaluation of the produced prototype (Project 4.2).
  o Details of the evaluation of prototype are outlined in Section 4.4 of the proposal.
- **Project 5.2: Final GIFT prototype.** We plan to produce final GIFT prototype built on the previous three GIFT prototypes (Projects, 2.1, 3.2, 4.2).
  o Technical/logistical details for this and other prototypes are specified in Section 4 of the proposal.
  o The content domain, evaluation population, and expected outcome (for evaluation of success) will be from **Project 1.1** and potential modifications from the third workshop **(Project 3.3)**.
  o The final GIFT prototype will be built upon all previous versions of GIFT prototypes (Projects 2,1, 3.2, 4.2) with the following requirements:
    ▪ It will be fully functional, satisfying GIFT prototype requirements (as result of Project 1.1) and additional requirements from the previous workshops (Projects 1.2, 2.2, 3.3) plus recommendations from the third-party evaluation team (CREP).
    ▪ It will be an improved version (incorporating new server and delivery technology) based on the most updated server/delivery technologies up to 2015.
  o Delivery content will be in three different domains.

Deliverables:

1. **Base Period** *(POP May 1, 2012 – December 31, 2012):*
   a. Initial literature review and ontology for Trainee Modeling (est. 4th quarter, FY12)
   b. Edited book and web portal for Trainee Modeling workshop (est. 2nd quarter, FY13)
      i. Commitment from workshop participants, publisher contract signed, etc. (est. 1st quarter, FY13)
   c. <mark>Initial analysis document on GIFT (est. 4th quarter, FY12)</mark>
   d. Initial documentation of formal model of ITS (the evaluation component) (est. 1st quarter, FY13)
   e. A report that includes recommendations for the next generation intelligent learning/training environments (includes initial/updated ITS formal model and highlights recommendations/suggestions from Trainee Modeling Workshop) (est. 1st quarter, FY13)

2. **Option 1 Period (***POP January 1, 2013 – December 31, 2013):*
   a. Design documentation and code requirements of prototype based on outcomes of first workshop (to include detailed collaborative discussion) (est. 2nd quarter, FY13)
   b. Initial literature review and ontology for Instructional Strategy Selection (est. 4th quarter, FY13)
   c. Edited book and web portal for Instructional Strategy Selection workshop (est. 2nd quarter, FY14)
      i. Commitment from workshop participants, publisher contract signed, etc. (est. 1st quarter, FY14)

    d.   An updated report that includes recommendations for the next generation intelligent learning/training environments (includes updated ITS formal model and highlights recommendations/suggestions from Instructional Strategy Selection Workshop) (1st quarter, FY14)

3. **Option 2 Period** *(POP January 1, 2014 – December 31, 2014)* **:**
   a. Updated design documentation and code requirements of prototype based on outcomes of second workshop (to include detailed collaborative discussion) (est. 2nd quarter, FY14)
   b. Outcome documentation on evaluation of the first GIFT prototype (est. 3rd or 4th quarter, FY14)
   c. Initial literature review and ontology for Authoring and Expert Modeling (est. 4th quarter, FY14)
   d. Edited book and web portal for Authoring and Expert Modeling workshop (est. 2nd quarter, FY15)
      i. Commitment from workshop participants, publisher contract signed, etc. (est. 1st quarter, FY15)
   e. An updated report that includes recommendations for the next generation intelligent learning/training environments (includes updated ITS formal model and highlights recommendations/suggestions from Authoring and Expert Modeling Workshop) (1st quarter, FY15)

4. **Option 3 Period (***POP: January 1, 2015 – December 31, 2015)* **:**
   a. Updated design documentation and code requirements of prototype based on outcomes of third workshop (to include detailed collaborative discussion) (est. 2nd quarter, FY15)
   b. Outcome documentation on evaluation of the second GIFT prototype (est. 3rd or 4th quarter, FY15)
   c. An updated report that includes recommendations for the next generation intelligent learning/training environments (includes updated ITS formal model) (est. 1st quarter, FY16)

5. **Option 4 Period (***POP: January 1, 2016 – December 31, 2016)* **:**
   a. Outcome documentation on evaluation of the third GIFT prototype (est. 3rd or 4th quarter, FY16)
   b. Final Report to include all documents, notes, source code, etc. (est. 3rd quarter, FY17)

6. **ADDITIONAL DELIVERABLE REQUIREMENTS:**
   a. Monthly status reports (due 15th of every month after award)
   b. Literature Reviews, Ontologies, and Formal ITS models are living documents and will be updated accordingly throughout the effort.
   c. All publications (academic articles and conference proceedings) derived from this effort will be jointly written between ARL (lead authors) and Memphis (co-authors).

Budget:

Base		
Labor	$32,773	
Other Direct Costs	$151,900	
Indirect Costs	$33,937	
Total		$218,610
Option 1		
Labor	$104,668	
Other Direct Costs	$189,400	
Indirect Costs	$80,839	
Total		$374,907
Option 2		
Labor	$117,116	
Other Direct Costs	$169,400	
Indirect Costs	$77,743	
Total		$364,259
Option 3		
Labor	$110,603	
Other Direct Costs	$72,500	
Indirect Costs	$75,075	
Total		258,175
Option 4		
Labor	$114,737	
Other Direct Costs	$92,500	
Indirect Costs	$84,967	
Total		$292,204
TOTAL COST OF EFFORT		**$1,508,155**