Cyberlearning and Future Learning Technologies Prospective PI Webinar

Spring 2014

Outline of presentation

- Cyberlearning & Future Learning Technologies (CFLT) Description
- Key Components of a Cyberlearning and Future Learning Technologies Proposal
- Examples
- Preparing Cyberlearning Proposals
- Other Related Programs

Cyberlearning and Future Learning Technologies Description

WHAT IS THE CYBERLEARNING PROGRAM?

Vision of the Cyberlearning Program

- New and emerging technologies will expand and transform learning—opportunities, interests, and outcomes—cradle to grave.
- The best of these will be informed by research on how people learn, how to foster learning, how to assess learning, and how to design environments for learning.
- New technologies give us new opportunities to learn more about learning

Cyberlearning Program Purpose and Goals

The purpose of the Cyberlearning program is to

1. advance design and effective use of the next generation of learning technologies, especially to address pressing learning goals, and
2. increase understanding of how people learn and how to better foster and assess learning, especially in technology-rich environments

By integrating opportunities offered by emerging technologies with advances in what is known about how people learn

A Cross-Directorate Effort

- CISE – Computer and Information Science and Engineering
- EHR – Education and Human Resources
- ENG – Engineering
- SBE – Social, Behavioral, and Economic Sciences

Cyberlearning Program Scope

- Populations, disciplines, and contexts for learning
  - any (not just STEM, not just formal)
- Technologies and interactions with them
  - any – hardware, software, combo, interactions with them, their integration into environments, must aim beyond state of the art
- Scholarly literature on learning and how people learn
  - Processes, representations, conditions, and influences associated with learning
  - Cognitive, neurobiological, behavioral, cultural, social, volitional, epistemological, developmental, affective, and other perspectives
  - Individual and collective learning

But remember: What you are doing must advance imagination about what is possible and have potential to really make a difference

Cyberlearning Proposal Types

Proposal Type	Award Limit and Duration
EXP: Exploration -- due March 19 in FY14 -- due in December in FY15 and beyond	$550,000* and 2-3 years
DIP: Development and Implementation -- due March 24 [corrected] in FY14 -- due in January in FY15 and beyond	$1,350,000 and 3-4 years
INT: Integration -- due mid-July (July 14th in FY 14) -- require a letter of intent, due mid-May (May 12 in FY14)	$2.5m and 4-5 years
CAP: Capacity Building	$50k and 1 year for partnerships, $100k and 2 years for conferences, workshops, short courses

Deciding which type of Cyberlearning proposal to submit

- EXPs are appropriate when the innovation is new and its properties aren't well understood
- DIPs are appropriate when the innovation has some proven track record and warrants further development and study
- INTs involve studying innovations embedded in larger, complex, realistic environments
- **IMPORTANT:** INTs are NOT efficacy, effectiveness, or scale-up research.

Cyberlearning and Future Learning Technologies (CFLT)

KEY COMPONENTS OF A CYBERLEARNING PROPOSAL

Key Components of a Cyberlearning Project

Addressing a pressing learning issue and/or technological opportunity, each project has:

- A technological innovation: a new genre or model for technology design or use, that is informed by, but pushes beyond, state-of-the-art
- Research advancing understanding of how people learn
- Research pointing towards broad use or transferability of the new genre

The two kinds of research are done in the context of iterative refinement of the innovation

EXAMPLES

Moher, EXP: Using technologies to engage learners in the scientific practices of investigating rich behavioral and ecological questions

- Issue: How to help kids (Grades 4 and 5) learn about natural phenomena that are not easily encountered and, in the process, carry out and learn practices of scientists.
- Innovation: Integration of immersive, measurement, and other technologies to simulate the field in the classroom
- Technology explorations: Development, enactment, evaluation, and iterative refinement of three multi-week prototype life-science investigations that vary in several ways
- Research advancing understanding of how people learn: Exploration of the development of learners' understandings of core concepts when they can experience natural phenomena; learners' adoption of scientific practices
- Research promoting broad use and transferability: Aimed at extracting lessons about designing and putting into use other learning activities that allow investigation of naturally-occurring phenomena and a larger, scalable program of such activity; affordances of the sensor technologies; challenges to their effective use, including pedagogical challenges.

Wilkerson-Jerde & Gravel, EXP: SiMSAM: Bridging Student, Scientific, and Mathematical Models with Expressive Technologies

- Issue: Middle schoolers making sense of complex (invisible) phenomena
- Opportunity: Adapt and use the tools of modern computational science.
- Innovation: A modeling environment, SiMSAM, that allows middle schoolers to make Stop-Action Motion animations to illustrate scientific phenomena, use those in computer simulations, and collect, analyze, graph, share, trade and test generated data
- Technology explorations: Develop, trial, evaluate, and iteratively refine SiMSAM as students use it to explore several kinetic molecular phenomena
- Research advancing understanding of how people learn: Exploration of new forms of learning afforded by such a toolset, shifts in learners' reasoning about causal mechanisms in modeled phenomena, their adoption of the model they are exploring as a conceptual model, their understanding of the nature of scientific models in STEM disciplines, pedagogical potential
- Research promoting broad use and transferability: How-to's of integrating such tools in ways middle schoolers can handle and that are engaging; affordances of such tools; challenges to their effective use, including pedagogical challenges.

Ashley, Littman, Schunn, DIP: Teaching Writing and Argumentation with AI-supported Diagramming & Peer Review

- Issue: Helping learners (college, professional, high school) analyze and synthesize sources and develop strong written arguments.
- Innovation: Integrate and extend tools for interpretation of argument diagrams (LASAD), natural language processing, and scaffolded peer interaction in (SWoRD) into a staged process for analyzing and integrating sources and developing arguments that distributes needed help between computer, peers, and teacher
- Technology development: Develop, trial, evaluate, and iteratively refine the integrated platform as it is used in law school classes, undergraduate science classes, and high-school science.
- Research advancing understanding of how people learn: Identify the roles computers might take on in promoting writing and the technology that enables that, how to distribute scaffolding between an intelligent machine and human agents, how to promote better writing, and how to promote learning through peer review of the writing of others.
- Research promoting broad use and transferability: How-to's of integration of such tools; how-to's of distributing help giving; differences in technology use and design, and in peer and teacher roles across disciplines and target populations.

Preparing Cyberlearning and Future Learning Technologies Proposals

HOW DO YOU DEVELOP A COMPETITIVE PROPOSAL?

Developing a competitive proposal

- Content
- Mechanics

Every project needs 3 integrated parts

1. A proposed innovation that is iteratively refined during the project
2. Research advancing understanding of how people learn (that requires the technology innovation)
3. Research promoting broad use and transferability

All focused by an important purpose and to be carried out by a team with appropriate expertise

What is an appropriate purpose?

- A pressing need that transcends disciplines, e.g.,
  - Drawing in learners who are not easily reached
  - Helping learners deepen understanding of difficult content or phenomena
  - Helping learners gain skills that are difficult
  - Helping learners develop interests
  - Helping teachers or other mentors provide excellent advice or facilitation
- Combined with an opportunity to use technology to address the need

Achieving the purpose should have potential to make a real difference.

What will reviewers will look for in your purpose?

- How important is it?
- How well have you justified its importance?
- How clear are you about what it will take to get there?
- How well do your innovation and research address it? How well-poised is your approach for eventually achieving that purpose?

What is an ‘innovation’?

A new or emerging technology; a new or emerging learning technology; a new or emerging configuration of learning technologies or sociotechnical systems

- Should be high impact, learner-oriented
- Must aim beyond state-of-the-art and be informed by scholarly research on how people learn
- Should have potential to transform
- Software itself has a short shelf life; <u>think about your innovation as representative of or a model for some new genre</u>

What counts as a “genre”?

- A new type or category of learning technology
  - E.g., support for synthesis and argumentation
  - E.g., crowd-sourced citizen science games that promote learning
- A new way to integrate or configure learning technologies
  - E.g., a workbench for student scientists that promotes learning as a computational scientist would
  - E.g., configuration for a next-generation textbook
- A new technology-rich learning environment
  - E.g., sensor and other technologies that bring the field into the classroom
- A new way to configure a socio-technical system
  - E.g., turning maker spaces into learning environments

What counts as ‘iterative refinement’?

- The innovation should be
  - Imagined and laid out in the proposal
  - Tried out in appropriate situations
  - With data collected about both its effectiveness and its way of being used
    - To allow understanding of what is working and not working and why
  - And results of analyzing that data used to make it better
    - by refining the technology or
    - by refining its use or the pedagogy around it
  - Then it is tried out again
- Formative evaluation is done in the context of iterative refinement

Read the literature on design-based research for more on how this is done.

What will reviewers look for in your innovation?

- What is the new genre or configuration of technology proposed? How well is it laid out in the proposal? How novel is it? How well does it advance state of the art?
- How well is it informed by research -- on technology, learning processes, targeted population, and so on?
- How well will your innovation address your purpose? What will learners' experience be like? What do you expect to happen as a result of that experience? How do you expect learner experiences to affect learning? How well-justified are your claims?
- How well will what you aim to build serve as a model or representative of the new genre?
- How will you build and refine it? What is your starting point? What is your process?

What is ‘advancing understanding of how people learn’?

- Proposals should present clear research questions and appropriate methods to address them
- Research should inform theory
  - About learning processes, fostering learning, assessing learning, and/or designing for learners
  - Advance understanding of processes involved in learning, representations those processes use, what happens through those processes, influences on those processes, and/or how to influence those processes
- In general, the answers to your questions should require the experience of using your technology innovation or collecting data in the context of its use
- Research in EXPs will shed light on answers and tell how to focus later research
- Research in DIPs will answer questions

Research advancing understanding of how people learn – what will reviewers be looking for?

- What are the research questions? How well formed are they and how well are they informed by prior work? How important are they?
- What literature(s) will they contribute to?
- What are your research methods, study design, and study context? How appropriate are your methods to answering the questions? How appropriate are your questions and methods to the stage of the innovation's development?
- How will your research add to theory? What new conceptual understandings will we learn from your research?

What is ‘research promoting broad use and transferability’?

- This research should extract guidelines for designing and using the new genre
  - For EXPs, affordances, challenges to effective use, and properties of use-in-context
  - For DIPs, design and use rules of thumb that others may use in developing applications and enactments
- Note: broad use and transferability are NOT about effectiveness, efficacy, scale-up, or broad dissemination (even in INTs)

Research on broad use or transferability – what will reviewers be looking for?

- What are the goals for understanding the potential for broad use or transferability? How appropriate are they to the stage of the innnovation's development?
- How will the proposed work yield progress on these goals?
- What will we know at the end of this project about how to promote or assess learning better that we did not know before?
- To what kinds of other innovations and applications will this new knowledge apply?

Team requirements

- Teams should include all of the expertise you need to achieve both your technical and research goals
  - spread across your researchers and your (required) advisory board
  - including expertise on learning processes and the targeted content, technology, learners, and practices of educating in the targeted environment.
  - must include expertise at design of learning experiences
- Advisory boards should include both
  - members who complement the expertise of researchers and
  - members who can contribute to critical review of the project.

Your team – what will reviewers be looking for?

- To what extent does your team have the expertise to carry out the project?
- To what extent has that expertise clearly been used in putting the proposal together?
- What is your plan for using that expertise well while carrying out the project?
- How well have you articulated team member expertise, roles, collaboration, and coordination in your Collaboration and Management Plan?

Integrating the parts -- advice

- Make clear the issue or opportunity,
- Describe your innovation and how you will iteratively create/refine it, and where it will be used/tested (to address the issue or further the opportunity),
- Propose research questions on how people learn that can be answered in the context of your innovation, and propose how you will study them (your questions should be relevant to the issue or opportunity you are addressing)
  - New experiences learners can have suggest new things that can be learned about learning
  - New data that can be collected may allow new things to be learned about learning
- Propose a plan for extracting design and use lessons that will allow others to use your innovation as a model.

The Proposal Preparation Instructions in the solicitation (Section V.A) provides specifics of what to include in each section of the proposal to make the different components and their integration clear.

In the end, … you should be aiming to produce 3 products

- At least one minimally-viable product that is representative of your new genre, points the way into the future, and addresses your stated purpose
  - To serve as a model of your new genre
  - Full-developed products are not required or requested
- New knowledge about learning
- New understandings about design and use of a new technological or socio-technical genre

Where can you find more guidance?

- The *Common Guidelines for Educational Research* might help you figure out how to integrate the parts of your proposal
  - Cyberlearning proposals typically combine Type 2: Exploratory/Early-Stage or Type 3: Design and Development with Type 1: Foundational
- Literature of Design-Based Research might also help you

Common Guidelines for Educational Research

Type	Description
1. Foundational Research	Basic research, methodology development
2. Early stage/ Exploratory Research	Descriptive/inductive, correlational, looking for connections
3. Design and Development Research	Research oriented towards designing/ engineering a learning intervention

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- The solicitation
- The Grant Preparation Guide (GPG)

NSF's criteria

- Intellectual Merit
  - Solidity, rigor, and intellectual interestingness of your proposed work
- Broader Impacts
  - Your proposed work's potential to address some important societal need

Both are equally important in Cyberlearning and Future Learning Technology projects

Mechanics

- Submitting
- Budget
- Required/allowable documentation
- IRB approval
- Critical information about your submission

Submitting

- Submit to fastlane.nsf.gov or grants.gov
- Collaborative proposals must go to fastlane
- All of the rules are in the *Grants Proposal Guide* and the solicitation

Budget

- Scope of work and budget must match; you do not have to request the maximum
- Cap of 2 months salary total across NSF grants for personnel with academic positions, unless justified
- No cost sharing allowed
- No undergraduate tuition; limited equipment
- Indirect costs may charged at each organization's government-approved rate.
- "Big" EXPs ($750k instead of $550k) require advance clearance

Allowable documentation

- Required
  - Collaboration and management plan (up to 3pg) – put in ‘supplementary documents’
  - List of PIs, co-PIs, senior investigators, and other participants – put in ‘supplementary documents’
  - Letters of commitment from project partners – put in ‘supplemental documents’
  - Postdoc mentoring plan (if applicable)
  - Data management plan – sharing and care of data
  - Reports of current and pending support and facilities
  - 2-page bios with a maximum of 10 citations
- Strongly suggested
  - Up to 5 screen shots – put in ‘supplemental documents’

Nothing else is allowed!

IRB Approval

- We are not allowed to recommend a proposal for funding until we have your IRB approval.
- Time your IRB request appropriately.

Critical information about your submission

Your submission will be returned without review if

- It is missing a collaboration and management plan
- It is missing a data management plan
- It is missing a post-doc mentoring plan (if you have a post-doc in the budget)
- In includes extra documents in supplementary documents section
- Formatting is not done correction (see Grant Proposal Guide for margins, fonts, etc.)
- “Intellectual Merit” and “Broader Impacts” are not identified as such in the Project Summary

Other Related Programs

OTHER CYBERLEARNING OPTIONS

Selected Cyberlearning alternatives

Sample Programs	Key differences
DRK12: Discovery Research K-12	Learning domain is STEM discipline Context is K-12 Potential applicability today
AISL: Advancing Informal STEM Learning	Learning domain is STEM discipline Context is informal learning environments Potential applicability today
ITEST: Innovative Technology Experiences for Students and Teachers	Learning aims towards technology-literate STEM workforce Audience is K-12 students and teachers
CHS: Cyber-human Systems	Research on humans and computing, not necessarily learning focused—contributes to literatures such as human-computer interaction
ECR: Education and Human Resources Core Research	Foundational research on learning (Not design/development focused)
REAL: Research on Education and Learning	Research aimed at understanding, building theory to explain, and suggesting interventions and innovations to address persistent challenges in STEM learning (not design/ development focused)
SBIR: Small Business Initiation Research (and STTR)	Exploration or development associated with putting a technology on the market

QUESTIONS?