

Welcome to the Prospective PI Webinar for the Cyberlearning and Future Learning Technologies program.

My name is Janet Kolodner, and I am a co-lead of the program.

My name is Chris Hoadley, and I am a co-lead as well.

The other co-lead is John Cherniavsky. We also have program officers from a variety of programs around NSF on our team.

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-- new slide – Outline of Presentation

The presentation today will have five parts: a description of the Cyberlearning and Future Learning Technologies program, presentation of the key components of a Cyberlearning proposal, some examples of Cyberlearning proposals and some lessons about structuring a project that can be gleaned from those, guidelines for preparing a Cyberlearning proposal, and, finally, a discussion of the relationship between Cyberlearning and other programs at NSF.

Before getting to the details, however, I want to point out that the purpose of today's webinar is to help you make your way through the solicitation and understand what is being asked for; please do not use this webinar as a replacement for reading the solicitation, as the solicitation itself has far more detail than we can provide in the time we have available.

-- new slide – What is the Cyberlearning Program

We begin by describing the program

-- new slide – Vision of the Cyberlearning Program –

We want to begin with the vision of the Cyberlearning and Future Learning Technologies program as laid out in the solicitation.

I'm sure that all of you are aware of a whole variety of new technologies that are becoming available. Tablet technology became affordable only in the past few years, new wearable hardware/software technologies seem to be springing up on a regular basis. Augmented reality is becoming more available and affordable, and as broadband becomes more powerful, it is becoming possible to share ever more sophisticated dynamic visuals in real time.

Each new technology that is invented or becomes available expands opportunities for fostering or assessing learning, and a big part of the vision behind the Cyberlearning program is that new and emerging technologies will expand and even transform learning and education. Some technologies will provide opportunities for seeing inside phenomena and understanding them better, others provide opportunities for access, others for collaboration and communication, and so forth. New and emerging technologies can offer new opportunities for learning and for fostering learning, opportunities for developing interests, possibilities for better learning outcomes, and more -- throughout a person's life.

In addition, the scholarly literature tells us a lot about processes involved in learning, how to foster learning, and how to assess learning, and the second part of the vision behind the Cyberlearning program is that the best new learning technologies and the most productive ways of using these technologies will be informed by that rich scholarly literature.

Finally, the last part of the vision is that with these new technologies and ways of using technology in place, we have new opportunities to learn more about learning -- about processes involved in learning, about how to foster learning, about how to assess learning, and about how to design learning technologies and technology-rich learning environments.

The Cyberlearning Program vision is that technology will be used in the most productive ways possible to help people of all ages deepen their understanding, enhance their capabilities, and develop interests and dispositions.

-- new slide – Cyberlearning Program Purpose and Goals --

With that in mind, the purpose of the Cyberlearning program, and its goals, are to, first, advance design of the next generation of learning technologies that can accomplish this vision. That is, we support projects aimed at inventing, exploring, and learning how to effectively use new technologies to help people advance their understanding and capabilities. And, second, those projects will also be aimed at bettering our understanding of how learning happens -- the processes involved in learning and how to better foster and assess learning, especially when learners are learning with technology or in a technology-rich environments.

This program is meant to help both researchers and practitioners grow their imaginations about what's possible with technology – through development of prototypes that show what's possible with technology and research that advances imaginations about what can be learned and understanding of how learning happens and how to foster learning.

-- new slide – A Cross-Directorate Effort

This is an ambitious program, and its goals will be best met if researchers from across research traditions and disciplines team up to achieve these goals. For this reason, this is a cross-directorate program. The Computer and Information Science and Engineering; Education and Human Resources; Engineering; and Social, Behavioral, and Economic Sciences Directorates are participating in this program.

-- new slide – Cyberlearning Program Scope –

Proposals to the Cyberlearning can focus on any population, discipline, or context for learning, as long as projects are aimed toward advancing imagination about what is possible with technology, are informed by what is known about how people learn, and have potential to make a real difference.

While many programs at NSF support projects that focus on STEM learning, that is not a requirement for Cyberlearning; the program seeks projects that focus outside of STEM as well (for example, language learning or history), and we encourage projects that are innovative in addressing outside-of-school learning contexts as well as school.

Proposals can focus on any technologies, integrations of technologies, and interactions with technologies – hardware, software, or a combination, interactions with technology or their integration into learning environments – again, as long as the project aims to advance imagination about what is possible with technology, is informed by what is known about how people learn, and has potential to make a real difference.

Finally, when the solicitation refers to learning, it is referring to people deepening their understanding, advancing their capabilities, becoming aware of when to use new knowledge and capabilities, coming to take the initiative to use what they are learning, and so forth – the things needed to interact productively in the workplace and the world.

That means that when the solicitation refers to “how people learn,” it is referring to processes involved in learning, representations used by those processes, conditions under which learning processes tend to be effective, and influences on those processes and representations.

We take a broad view on which processes, understanding that cognitive, neurobiological, behavioral, cultural, social, volitional, epistemological, developmental, affective, and other processes and conditions all affect each other and influence what is learned.

This program seeks projects that focus on collective learning as well as those that focus on individual learning.

-- new slide – Cyberlearning Proposal Types

This program supports four types of proposals.

Exploration proposals (EXPs) are for exploring new technologies and their possibilities and exploring the answers to fundamental questions about learning. They are funded for 2 to 3 years and \$550,000. These proposals are due on March 19 this fiscal year and will be due in December in upcoming fiscal years.

Development and Implementation Projects (DIPs) are for learning more about the potential of an emerging technology and answering fundamental questions about learning. These projects are funded for 3 or 4 years, and you can ask for up to \$1,350,000. These proposals are due on March 24 this fiscal year and will be due in January in upcoming fiscal years.

Integration projects (INTs) can be 4 or 5 years in length, and you may request up to \$2.5 million dollars. These are the program's largest projects, and they are for the purpose of integration –coherently integrating several emerging and/or developed technologies that have shown promise, incorporating promising technologies into the lives or learners or organizations, or extending a promising innovation in ways that would allow it to be used by a larger population or variety of learners, ... and for answering foundational research questions related to learning that can only be answered in the context of such an integration. Proposals are due in mid-July, and Letters of Intent for these projects are due in mid-May.

Finally are Capacity-Building Projects (CAPs). Each of the three types of projects just listed requires that you have an interdisciplinary team in place for your project. One purpose of capacity-building projects is to help you grow an interdisciplinary team that will work together long-term on Cyberlearning projects and request Cyberlearning program support in an upcoming competition. You can ask for up to \$50 thousand dollars for that.

Or, a capacity building proposal, can be for purposes of strengthening the cyberlearning community, for example, a workshop for introducing communities to each other or aimed at enhancing the strengths of the cyberlearning community. You may ask for up to \$100 thousand dollars for this purpose.

Capacity-building proposals can be submitted any time; we make sure to gather together and move forward on anything we've not moved on by the target dates that are listed.

-- new slide – Deciding which type ...

How do you decide which to apply for?

Exploration projects are for when an innovation is new and its properties and uses are not well understood or for when a technology has not been used for fostering or assessing learning in the past.

Development and Implementation Proposals (DIPs) are appropriate when the innovation has a bit of a track record; you've tried it out and understand its affordances and challenges to using it well, and you know some things about the research you might carry out in its context. You will want to put in a DIP project only if you have completed the equivalent of an EXP, that is, if you have all of the results in hand that would be expected from an EXP.

Integration projects (INTs), as I said earlier, are for focusing on integration. It is expected that technologies being studied in these projects will have a track record but that the integration requires further intellectual activity. I will not say a lot more about these today, as we will plan another webinar later in the spring to discuss these, but I want to point out that **THESE ARE NOT SCALE-UP PROJECTS OR EFFECTIVENESS OR EFFICACY STUDIES.**

-- new slide – Key Components

There are a variety of programs at NSF that support research around the theme of learning with technology. The Cyberlearning Program is only one venue for proposals related to Cyberlearning.

This program is for projects that push the envelope further in terms of imagining, inventing, and exploring new technologies and ways of using them in support of learning, carry out foundational research on how people learn that could not be done except with the proposed

technology, and that help us know how to design and use these new types of learning technology.

We expect each project in the portfolio to make contributions in all three areas. Every proposal to the Cyberlearning Program should include all 3 key components in the context of addressing a pressing learning issue or technological opportunity:

- a technological innovation
- research focusing on how people learn, and
- research pointing towards some new model for designing or using technology to foster or assess learning

Your innovation may or may not be brand new – it does need to be a new or emerging genre, or model, for designing or using technology -- but it does need to push beyond state of the art; you need to take advantage of what the technology makes possible as well as what we know about how people learn. You will refine the technology and/or the way it is used to address the stated goals, learn more about learning in its context, and draw out lessons that will allow others to design and use applications that fit your new model.

-- new slide – EXAMPLES

I'll present a lot more specifics about what we mean by each of these parts this later. But first I want to show you some examples of funded Cyberlearning projects to anchor all of these descriptions in something concrete.

As I go through these examples, please notice the pressing issue and technological opportunity being addressed, the technological innovation and in what ways it models a new genre (or type), the research on learning, and the research pointing towards how to use the new genre.

-- new slide – Moher ...

The first project I want to tell you about was done by Tom Moher and colleagues at the University of Illinois in Chicago. Tom is a computer

scientist; he is working with learning scientists, science education researchers, and disciplinary scientists on this project. This was an Exploration project, and they wanted to help elementary schoolers learn about natural phenomena that are not easily encountered – earthquakes, infestations of alien species, the solar system in action, and others – and in the process carry out and learn many of the argumentation, measurement, and interpretation practices of scientists.

Their innovation is to integrate lo-fi immersive technologies, measurement technologies, and others into classroom activities so that children can experience phenomena as if in the field. For example, the children experience earthquakes through a rumbling sound that goes through the classroom and then examine seismographs placed around the room and triangulate from those seismographs to find the epicenter. After several weeks, they eventually identify where the (simulated) plate boundaries located in the classroom. Screens set up around the classroom each represent an insect colony, and the colonies can affect each other, as in the world; students have probes for counting, measuring, and so forth. They can insert new species and enact interventions. Their challenge is to counter infestation by an alien species; the decisions made about different colonies in different classrooms affect the other colonies.

Cyberlearning funding supported these researchers as they developed, enacted, evaluated, and iteratively refined three multi-week prototype life science investigations, each differing in how much students could control the technology, the information supplied by the technology, and the teachers' pedagogical moves.

Their research on how people learn explored two things: (1) development of learners' understandings of core concepts when they can encounter and explore those real-life events in some embodied form, and (2) learners' development and adoption of the practices of field scientists and what influenced that. Their research promoting broad use and transferability focused on extracting lessons that can be used in designing other simulations of field phenomena for elementary classrooms.

-- new slide – Wilkerson-Jerde and Gravel ..

This one is another EXP, Michelle Wilkerson-Jerde and Brian Gravel at Tufts are focusing on how to help middle schoolers make sense of complex phenomena. A lot of science today is carried out through sophisticated simulation and modeling, and they are exploring how to use these new ways of doing science to help middle schoolers' understand invisible phenomena. Michelle is a learning scientist, while Brian is in engineering education and is a technology developer and inventor.

Their innovation is a new kind of modeling environment designed specifically for middle schoolers. It combines Stop-Action-Motion animation with simulation and modeling to help middle schoolers, who are known to have a hard time making connections between a model and what is happening in the real world, grasp those connections.

Their technology exploration involves developing the environment, trying it out, evaluating, and iteratively refining it as students explore kinetic molecular phenomena in a variety of situations – air pressure, sound propagation, and evaporation. In each iteration they are refining the software and the pedagogy to do a better job of helping the kids understand the science and carry out scientific practices of computational science.

Their research on advancing understanding of how people learn explores how learners' conceptions of and reasoning about causal mechanisms evolve and how their understanding of the nature of scientific models evolves; they are aiming towards understanding how to foster learning about such mechanisms.

Their research on promoting broad use and transferability of their technology focuses on the affordances of this new kind of tool, the challenges to their effective use, and how to integrate and introduce their use in ways that are manageable by the teacher and that foster learning.

-- new slide – Ashley, Littman, Schunn ...

Finally, I want to show you a DIP project. This one is being done by Kevin Ashley, Diane Littman, and Chris Schunn at University of Pittsburgh. Kevin and Diane are artificial intelligence researchers, Kevin also does legal education and Diane works on intelligent tutoring, and Chris's expertise is science education.

This team wants to help a wide variety of learners analyze and integrate sources and develop strong written arguments. Such integration and argumentation is important in science as well as in law and in other disciplines.

Their proposed innovation builds on existing tools they have developed for peer review and argument diagramming – remember that this is a Development and Implementation Project. Those tools have natural language understanding and diagram interpretation capabilities, and the researchers already know that the capabilities of the tools are not sophisticated enough for the tools to automatically help learners integrate sources and develop arguments. Rather, they have some understanding about how to integrate the tools into the life of the classroom, and they believe that the future of intelligent tutoring systems for ill-structured domains will be in integrating tools that can structure discourse and scaffold reasoning into the activities and practices of learners so that peers, teacher, and tools can augment each other. Their hypothesis is that the particular tools they are integrating will be useful in fostering integration and argumentation skills if they can be leveraged in particular ways by agents in the learning environment; their innovation is the integration of these tools AND the scaffolded peer interaction they support into the learning activities students are already engaging in.

Their technology development activities include further development, trial, evaluation, and iterative refinement of the integrated platform and its use in law school classes, undergraduate science classes, and high-school science. They are trying out the platform and its use in a variety of contexts.

Their research advancing understanding of how people learn focuses on 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 foster learning through peer review of the writing of others.

Their research on promoting broad use and transferability of the innovation focuses on the how-tos of the integration of the tools with each other and their integration into the three very different classroom environments, the differences in the way the tools and the peer interaction they support might be used among different populations and in different disciplines, and peer and teacher roles in its effective use.

-- new slide -- How do you develop ...

Now that you've seen some examples, I want to give you some advice about developing a competitive Cyberlearning proposal.

-- new slide -- Developing a competitive proposal

There are two issues I'll address – the content and the mechanics, and as I address content, I'll talk both about what is necessary and what reviewers will be looking for.

-- new slide -- Every project needs the 3 integrated parts

Every project needs the 3 parts specified in the solicitation, all integrated through a common purpose and done by a team that has the expertise to be successful. Let me go over each, beginning with the purpose, as your proposal should be achieving the purpose you put forth.

-- new slide -- Purpose

Every proposal should make its purpose clear early on. You should be aiming to achieve some pressing societal need related to learning and have some vision of the way technology can be used to achieve your goals. I have a few pressing needs listed here; there are others listed close to the beginning of the solicitation. Or, choose your own; the list in the solicitation is not meant to be complete. In the examples, the pressing needs were around understanding complex natural

phenomena, learning to reason scientifically, and making cogent arguments.

Whatever purpose you choose to address, it should be something important; achieving it should have potential to make a big difference.

-- new slide -- purpose – what will reviewers be looking for?

Reviewers will be judging how important what you want to accomplish is and how well you have justified its importance. They will also want to see that you know what it will take to achieve that purpose and will be looking to see the extent to which your technology and research aim you toward achieving your goals.

-- new slide – What is an “innovation”?

What is an “innovation”?

We move on to the innovation, the first technical part of your proposal. For the purposes of this program, we want you to think about an innovation as a new or emerging technology that can be used for fostering and/or assessing learning, or a new or emerging configuration of learning technologies or socio technical systems for those purposes. It should have potential for high impact; it should be focused on the needs of learners as they are engaged in learning. The innovation should aim beyond state of the art and be informed by prior research – research on processes involved in learning, research on use of the technology, and research on how to use the technology to promote learning. Your innovation needs to be more than a new app or piece of software; you should think about whatever you are developing as a representative of a genre or as a model of some new type.

If you look back at the examples later on, you will see that each focuses on the resources, representations, and experiences learners need to develop understanding and competence, and each is informed by what the literature tells us about cognitive issues in learning targeted content and skills and sometimes developmental issues and issues of engagement as well.

And for each, even when a new operating system or new way of interacting is created, there is a lot that will live on from the project and that will be able to inform future implementations – how-to’s of integrating software functions, how-to’s of pedagogy when learners can have certain kinds of experiences that technology makes possible, how-to’s about what software should show learners so that they can make sense of phenomena, how-to’s about using technology to help middle schoolers make sense of invisible phenomena, and so forth.

-- new slide – What counts as a “genre”?

A new “genre” may be a new type or category of learning technology, a new way to integrate or configure learning technologies, a new technology-rich learning environment, or a new way to configure a socio-technical system. This slide names the genre proposed by each of the three projects I presented; it also has a few more examples. In another funded project, Kurt Squire and his team at Wisconsin are focusing on how to design crowd-sourced citizen science games so that they intentionally promote learning (while still being engaging). A way of configuring technology for a next-generation textbook that specifically targets the needs of certain populations or types of disciplines would be another example of a new genre. Another funded example comes from Erica Halverson and Kimberly Sheridan; they are exploring how to turn maker spaces into environments where learning happens systematically (again, without losing the excitement of making).

-- new slide – what counts as iterative refinement?

The solicitation asks you to use a process of iterative refinement to make your innovation better over the life of the project and to draw out lessons about design and use. In iterative refinement, you are developing and then trying out your technology in appropriate situations, gathering data about its effectiveness, the way it is used, and what happens, then analyzing that data to identify challenges and opportunities, and then refining the innovation based on that analysis and trying it again. In some cycles, you might refine the technology itself; in others, you might refine the way it is used.

The formative evaluation part of your endeavor happens during iterative refinement. You will need to collect data about effectiveness so that you know whether your refinements are actually making the innovation better; you will need to collect data about the ways the innovation is being used and what happens while it is being used so that you know what it is about the innovation that needs refinement.

There is literature on design-based research that the solicitation points you to; it is worth being familiar with this approach.

-- new slide – innovation – what will reviewers be looking for?

So what will reviewers be looking for when they judge your innovation? They will look to see what new genre you are proposing, including its novelty and how well it might advance the state of the art. They will judge how well the design and use of your innovation are informed by current research –on technology, learning, the needs of your target population, educational practices, and so forth. They will want to see, by the way, how you are building on specifics of what is reported in the primary literature and not simply how you are using what is reported in lay articles and secondary sources.

They will judge how well they think your innovation will address your stated purpose. And perhaps the biggest part of making that judgment will be their analysis of the experiences you expect learners to have. They will be looking to see how you envision the experience of learners and judging to what extent they think learners' needs will be addressed. So make sure you make the experiences of learners clear. You are allowed to put up to 5 screen shots (no more than 5) in supplementary documents to help make the experiences of learners clearer; we strongly urge you to take advantage of this extra-page allowance.

Reviewers will also want to know how you will build and refine your innovation; they will be especially interested in your proposed initial design and your iterative refinement process.

-- new slide – what is “research advancing understanding of how people learn”?

The second part of each Cyberlearning project is research advancing understanding of how people learn. Proposals should present clear research questions and methods to address them; the research questions should inform theory – theory about processes involved in learning, how to foster learning, how to assess learning, and/or how to design for learners. The research should be carried out in the context of your iterative refinement, and it might inform about development of understanding or capabilities, cognitive needs during learning, social needs during learning, perhaps under what circumstances certain kinds of feedback is useful or how to collect or analyze certain kinds of data; you will use literature on how people learn to inform the design and use of your innovation, and you should be aiming to also contribute back to the literature on how people learn.

We can again look back at the three examples to give you a better idea. Moher’s research on how people learn was looking at how learners develop their understandings of core concepts when they can experience those as if in the field and how learner’s adoption of science practices evolves as they do science the way field scientists do. Wilkerson-Jerde and her team are aiming to identify shifts in students’ reasoning about causal mechanisms when they can explicitly model them and what it looks like as learners come to understand that their models actually are analogous to what is going on in the world. Ashley and team are exploring how to distribute scaffolding between intelligent machine and human agents and how to promote better writing and learning through peer review of the writing of others.

-- new slide – Research on how people learn

When reviewers read this part of your proposal, they will be looking, first, for the specific research questions you will address. They will look at how well formed they are and how well they are informed by the literature. They will judge their importance. They will look to see what literatures your research will contribute to.

They will also judge your research methods, study design, and study context, especially looking at how well your methods are matched to answering your questions and how well your questions and methods are matched to the stage in your innovation's development.

Especially important is that your research add to theory – it could be theory of how people learn, how to foster learning, how to assess learning, and/or how to design for learners; the important thing is that you add conceptually to what is known already, going beyond adding an evaluated example.

For EXPs, your research should shed light on the answers to your questions and help you know how to move forward in actually answering them.

For DIPs, you should be aiming to answer important questions.

In the past, PIs have been confused about the relationship between hypotheses and questions. Your hypotheses help you to develop research questions. Your research questions tell reviewers about exactly how you will explore your hypotheses.

-- new slide – what do you mean by 'research promoting ...'?

Finally, every Cyberlearning proposal needs to include a plan for extracting lessons about the new genre that is being developed. What does it look like in practice? What are its affordances? How should it be used? What are the challenges to its effective use? What design principles should be used for creating new instances? For making it work in different kinds of situations? We expect that you will be collecting data during iterative refinement that will help you answer questions like these.

Again, let's look back at the 3 examples. Moher's team focused this part of their research on extracting lessons that can be used in designing and putting into use other learning activities that bring naturally-occurring phenomena into classrooms; a particular focus of their work, by the way, was the teacher's role in making these activities work to promote learning. Wilkerson-Jerde and Gravel are focusing on the how-to's of

integrating tools together in ways that middle schoolers can handle; an integration allows several tools to be used in conjunction but adds complexity at the same time; they want to find out how to do such integrations, especially in the context of simulation and modeling, so that middle schoolers can handle the integration. They, too, are focusing on pedagogical challenges to effective use. And Ashley and team are focusing on differences in technology use and needs across populations and disciplines and extracting lessons that are not simply about law and science but about the roles peers and teachers might take on across disciplines and target populations.

-- new slide – Research on broad use ...

Remember that research on broad use and transferability is the research you do to better define or describe the new or emerging genre you are creating or refining. How should applications be designed? How should they be implemented? How should they be integrated into the life of the learning environment?

For an EXP, you will be aiming to learn its affordances (what it allows), how it might be used, and challenges to its effective use. For a DIP, you will be aiming to derive rules of thumb about design or use.

With this in mind, reviewers will be looking, first, to see what your goals are for understanding the potential for broad use or transferability and how appropriate those goals are for the stage of development you are at.

They will look to see how well the proposed work will yield progress on those goals and for what we will know at the end of the project about how to use technology to promote or assess learning that we didn't know before.

They will also be judging the scope of what you are proposing. How far beyond your particular implementation will the things you are learning about design and use apply? Are you aware of how far they might apply? How cautious are you in making those claims?

-- new slide – team requirements

Doing all of this will require the right team. Indeed, this solicitation sets a very high bar on getting the right team together; we believe that's necessary to achieve the program's vision.

The solicitation states requirements about team membership. You need on your team all of the expertise needed to achieve your technical and research goals. Some of that team will be the researchers themselves -- PIs, co-PIs, senior investigators, post-docs, and students. Your team may also include implementation and/or enactors (e.g., teachers). Your team also includes advisory board members. Among all of those people, the team should have expertise on learning processes, targeted content, targeted technology, targeted learners, and practices of educating in the targeted environment. And the team must include expertise at designing learning experiences; note that people who know how to analyze learning are not always the same people who know how to design for learners.

One more thing about your advisory board – it should have two kinds of participants – those who complement the researchers and those who can contribute to critical review; they may be the same people or they may not be. Be clear in your Collaboration and Management Plan how you will use advisory board members for both purposes.

Participants in your project – PIs, co-PIs, sub-contractors, advisors, and so forth – should be those who can best contribute to the project. There are, however, some budgetary issues with respect to what for-profits can ask for and what can be paid to organizations in foreign countries. Look in the Grant Proposal Guidelines for specifics about those restrictions, or send an email with your specific questions.

-- new slide – Your team – what are reviewers looking for?

Finally, with respect to what reviewers are looking for, they want to be assured that your team can successfully carry out the work. They want to see that your proposal that was written by your whole team and to know how the team will be used in carrying out the project. Your proposal should clearly include the voices of all of the experts, and you

have up to 3 pages in the Collaboration and Management plan to make clear how the team will collaborate to carry out the project.

-- new slide – Integrating the parts

So how do you pull all of this together? We have some advice.

First, make your issue and/or opportunity clear very early on, and make sure you are always keeping it in mind as you develop the rest of the proposal. Your innovation should address your issue, and your plan for iteratively refining it should clearly state how what you know about addressing that issue is informing that plan.

Your research questions should be questions that can be answered in the context of your innovation, usually questions that could not be answered without the innovation. New experiences learners can have with your technology and new data that can be collected may suggest new things that can be learned about learning or new ways of answering questions about learning. Think about integrating your research with your iterative refinement; what data can you collect in each iteration that will help you answer your questions?

Your plan for extracting out design and use lessons should also be integrated with your iterative refinement. As you are collecting data to refine your innovation, collect data and analyze it in ways that will allow you to help others know how to design and use similar applications.

The proposal preparation instructions in the solicitation provide specifics of what to include in each section of the proposal to make the different components and their integration clear.

-- new slide – In the end, ...

In the end, you should generate three products -- (1) at least one minimally-viable product that is representative of your new genre and that points the way into the future of learning technologies, (2) new knowledge about how people learn, how to foster learning, how to assess learning, and/or how to design for learners, and (3) new

understandings about how to design and use the new genre you are proposing.

-- new slide – Where can you find more guidance?

Some of you know about the Common Guidelines for Educational Research. These are guidelines put together and published by NSF and the Department of Education (IES) together. They don't quite fit Cyberlearning proposals, because they assume a sequential approach to research and development. However, they do give advice about how to integrate the parts of a research and development project coherently. We suggest you look at this document; there is a pointer to it in the solicitation.

In general, Cyberlearning proposals will combine Type 2 (exploratory/early state) or Type 3 (design and development) with Type 1 (foundational) research.

-- new slide – Common guidelines ...

This slide shows you the 3 types in the Common Guidelines that you might want to read about and that might provide you with help in organizing your project. We did not include large-scale field testing, scale-up, efficacy, and effectiveness studies here, as we don't expect Cyberlearning projects, even Integration Projects, to engage in those activities.

--new slide – where can you find (reprise)

Looking back again at where you can find guidance, I also want to point out again that the literature on Design-Based Research might also be helpful to you in figuring out how to integrate all the parts; there are pointers to this literature in the solicitation as well. And, of course, the solicitation and the Grant Preparation Guide (the GPG) provide advice. The section of the solicitation with instructions for preparing a proposal

includes a lot of advice about how to organize the proposal so that reviewers will be able to find what they are looking for.

-- new slide – NSF's criteria

Remember: Reviewers need enough information in your proposal to be able to judge your project's merit – both its importance and its chances of success. Provide them with enough information in the proposal so that they don't have to guess at what you are planning to do or why you are planning to do things the way you propose; reviewers tend not to trust "trust me" proposals. Make sure they will easily find the answers in your proposal to all the questions asked in previous slides.

They will judge the intellectual merit of your proposed work and its potential for broader impacts. Intellectual merit has to do with the solidity, rigor, and intellectual interestingness of your proposed work. Reviewers will judge this by reading the descriptions of your innovation and research.

Broader impacts is the potential for your proposed work to address some important societal need. Reviewers will judge this by examining the pressing need you present as your project's purpose and judging the extent to which your project realistically addresses that need.

-- new slide – Mechanics

Okay, we're on the home stretch – mechanics – how to submit, the budget, required and allowable documentation, IRB approval, and the things that would cause us to send your proposal back without review.

-- new slide – Submitting

The easiest way to submit to NSF is through fastlane, but you can also submit through grants.gov.

Collaborative proposals, however, must be submitted through fastlane. These are the ones that have several budgets attached to one project narrative.

Be sure to follow all the rules in NSF's Grants Preparation Guide and solicitation.

-- new slide -- Budget –

Budget – your scope of work and budget must match; you don't have to ask for the maximum if you are proposing something small.

There is a 2-month cap on the salary of personnel with academic positions (tenure-track people whose salary is covered by the institution). For these people, no more than 2 months of salary will be paid by NSF across all of your NSF-funded proposals in any year unless you can justify it.

No cost sharing is allowed; that means that you and your organization cannot contribute anything to the project beyond what you are asking from NSF. You should, however, discuss in the proposal the relationship between the proposed project and other projects you are working on if they provide infrastructure for what you propose. If you have particular questions about what counts as a contribution, send an email to one of us, and we'll help you sort it out.

We do not pay undergraduate tuition, and we will pay only for equipment needed specifically for your project.

In the past, we've been asked whether for-profits can charge profit; organizations can charge overhead at whatever are their government-approved rates.

Finally, the solicitation allows some big EXPs. These require advance approval from a program officer and are generally only for those who

have a need to build sophisticated integrations of software to do their work. Send an email to me if you want such approval.

-- new slide – Allowable documentation

Cyberlearning proposals require all of the following documentation:

-- a collaboration and management plan, in the supplementary documents; the solicitation tells you what belongs in it

-- a list of all known participants – PIs, co-PIs, senior investigators, post-docs if you know who they are, advisory board members, subcontractors, and so forth. Use the format specified in the solicitation.

-- letters of commitment from project partners. These, too, go in supplemental documents. It is not necessary to have letters from PIs, co-PIs, and senior investigators; we assume your institution has those people sign off. We do, however, want letters from organizations you will work with, subcontractors, and advisory board members. Let those people write their own letters, please; if all the letters are clearly written by you, reviewers will notice and wonder how excited those collaborators are about the project. Please make sure to get agreements and letters from everybody you list as participants; people should know you listed them as advisory board members.

-- if you have a post-doc, you need a post-doctoral mentoring plan

-- NSF proposals must all have data management plans; these plans need to tell us both about how you will share the data and how you will take care of it; look in the GPG for more detail about what they should include.

-- and, of course, every proposal needs reports of current and pending support and facilities, as well as 2-page bios of all senior personnel, each with a maximum of 10 citations. You may also include 2-page bios of advisory board members.

Also, as I noted earlier, we strongly urge you to include up to 5 screen shots in the supplemental documents to show what learners' experiences will be.

Nothing else at all is allowed.

-- new slide – IRB approval

The one thing I want to say about this is that we need to have your approval in hand before we can recommend funding. So time your IRB request appropriately; NSF asks that you send it in when you submit the proposal, and from my point of view, that's a good idea.

I'm sorry the slide does not say this, but we aim to make recommendations in June and July for funding to begin in August or September.

-- new slide – Critical information about your submission

Which brings us to the things –omissions or additions that would cause return of your proposal without review.

- missing collaboration and management plan
- missing data management plan
- missing post-doc plan if you have a post-doc in the budget
- extra documents beyond those that are allowed
- formatting problems, for example, your project description going over 15 pages, use of tiny type, or very narrow margins
- and failure to specifically identify Intellectual merit and broader impacts in your project summary

-- new title slide – Other related programs

I have spent all of this time talking about this one program, though I did mention earlier that there are other programs you might want to send proposals to.

-- new slide – Selected Cyberlearning alternatives

This slide shows you some of those programs and lists key differences between them and the Cyberlearning program; I will not go over all of them, as you will have access to the slides. But notice that if you are specifically focusing on technology for learning some particular STEM content, it would be better to apply to DRK-12, AISL, or an undergraduate education program. And if you are focusing on the ins and outs of using a technology but without actually working on design or refinement, then REAL is more appropriate. If your focus is on humans and computers interacting and you are focusing primarily on the technology or interactions and not specifically on the nitty-gritty details of fostering or assessing learning, then CHS is a better program to apply to. If you are focusing on a new way of approaching curriculum, then DRK12, REAL, or ECR would be appropriate. If your aim is to get a product out to market, then you should apply to SBIR or STTR. And so forth.

-- new slide – Questions

We're happy to take questions at this time. We are also happy to receive questions by email, and we will respond to those as quickly as we can.