How Do I Learn: Achieving a Synthesis of Content, Pedagogy, and Modality at Scale

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The grant's specific purposes are threefold: First, to develop teachers' understanding of the latest developments in Neuroscience content knowledge, to help them find ways to communicate this knowledge to students, and to help them find ways to use this knowledge to augment their practice in scientifically-validated ways. Second, the grant required that the Institute work to develop middle-school students' interest in careers in Neuroscience and physiology. Third, the Institute bears responsibility for sharing this knowledge with parents in the local community, so that they might use this knowledge to inform their parenting.

From a design perspective, each of the grants' goals presents a 'wicked problem,' or a situation with many "unknowns" and multiple potential solutions. Thus, the Institute enlisted three sources of local expertise to navigate the process. The first came in the form of professors of neuroscience and physiology from the university's globally-

recognized biological sciences departments. These faculty members agreed to come and present up-to-date knowledge to the teachers, and to outline relevant and useful information about the developing brain and mind in the middle-school years. These experts were asked to present on topics such as the importance of sleep for learning, the biochemical basis of the brain, and the cognitive science of attention. Second, the Institute partnered with the university's education outreach program to find ways to make the Institute's resources available to the general public.

In addition to these experts, the Institute reached out to learning scientists at the university's Innovative Learning Center (ILC) to help plan the pedagogical and organizational components of the class. The ILC in turn recruited graduate students and faculty to help construct some of the necessary course resources to support the grant's larger goals. This included the development of a resource website that could serve as a structure for the course, and as a resource for the broader community.

The contributors oriented the site's content around a scientifically-validated instructional model known in the literature as 'anchored instruction', that evolved into 'The Legacy Learning Cycle' or 'Mosaics.' The anchored instruction model, by design, promotes metacognitive learning through a combination of neural engagement, self-knowledge about how ones thinking is shifting and generative ideation in small and large collaborative groups. Through this process, learners make visible their own pre-conceptions and compare them against expert perspectives provided on the site. In this way, learners come to understand their own mental models of the world, and must reconcile the potential instances of cognitive dissonance that occur when those models are challenged by new information. The ILC team developed the resource site to mirror

the Institute's summer seminar through a series of modules that represented the content of one segment of the five-day event. However, unlike conventional resource sites, which are ordered around content structures that are external to learners' thinking, the modules in this site were oriented around a pedagogical cycle that scaffolds the learners' thinking from existing structures that the learner develops themselves. In the context of this larger project, the authors began to call the LLC-based resource site and online community by the name "NeuralNet," as this reflects the social nature of the project as it evolves.

The first iteration of the Institute's five-day seminar occurred on the university's campus during the first week of August in 2012. Unfortunately, technological difficulties arose that prevented the roll-out of the website with the first cohort. While the ILC team constructed the website in time (using a WYSIWYG website development service called Weebly), the team had significant difficulties in finding a way to capture learner responses and provide them to the learner for later review. One solution, an online classroom journaling platform called Penzu, was deemed too cumbersome. For this reason, the institute used the website in conjunction with paper-and-pencil assignments that they collected twice daily during the seminar. In this way, the Legacy Learning Cycle was enacted socially in the classroom with minor technological support (PowerPoint, laptop-based word processors, and YouTube videos).

Developing Technology to Support Professional Development

After the partial-failure of the Weebly-Penzu system (due to the complexity of creating new accounts), the author took stock of his knowledge regarding the development of technological tools for learners. In his memory, he thought over his work with Learning Management, Electronic Performance Support Systems, and other in-

practice modes of instructional design that could support teachers beyond the confines of the course. In the short-term, the Institute has chosen to use Wiggio (an online service selected by the school district) as a platform for hosting discussions and file-sharing, coupled with an online conferencing platform to support the monthly PLCs. Curiously, as a result of the first PLC in November, the authors learned that most of the teachers had never attended any form of online PLC, and required class-time for learning to use the tools. However, the Wiggio platform has already begun to yield fascinating insights into the form and nature of the online course.

The Institute's committee had decided to develop and pilot the seminar as a self-paced online course for teachers who could not attend the summer seminar. This pilot will occur in February, and will use the university's installation of the Canvas Learning Management System to deliver the same content (including videos of the presentations from the summer seminar) to the new learners. The Canvas LMS provides the necessary interactivity for learners (e.g. the ability to submit their initial thoughts and review/comment on them later, and the possibility of online collaborative discussions of the content with other teachers). The Institute also has plans to release a MOOC version of the course, but this idea is currently in an evolutionary phase, and will involve a number of path-dependent decisions that are unclear as of the present.

Research Questions

While the authors are interested in the application of exotic and high-technology to instructional purposes, the community-oriented nature of this project requires the use of a common-denominator system. That is, because the project managers would like people to use and learn from this course, it cannot assume levels of technological access

that exceed those found in libraries, schools, and homes. This precludes the use of augmented reality, mobile learning technologies, and many forms of advanced software, as they are relatively expensive and difficult to integrate into classrooms without continued technological investment. Thus, whatever technological tools are created or chosen, they must be accessible to and by everyone (e.g. physical access as well as 508 compliance, on a variety of devices), they must be easy to use and learn, and they must provide the ability to collect, store, and retrieve learners' responses without involving a separate system

As with all constraints, however, this presents an opportunity to begin testing a much larger and directly relevant question related to the development of instructional technologies. That is, at present, Learning Management Systems are created with the goal of remaining agnostic in regards to instructional design strategies. Instead they rely on the individual instructor's ability to design learning materials and integrate them into a technological platform. However, the bulk of higher education faculty and K-12 teachers are not necessarily experts in the processes and content knowledge necessary to engage in this kind of work. Therefore, this project presents an opportunity to build instructional design processes into a LMS in ways that scaffold and augment the development of learners' expertise at a variety of levels.

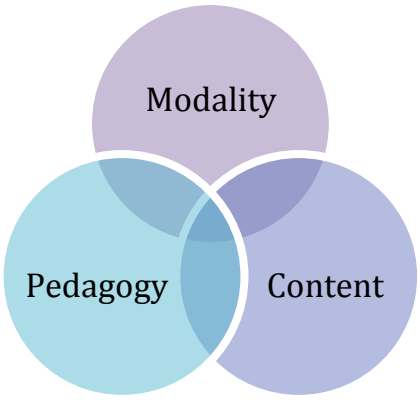


Fig. 1: The Content-Pedagogy-Modality Matrix

Research questions addressed in the case study help to shed light on the development of a new kind of multimedia metacognitive-calibrated website architectures to be used in blended learning environments. The key research questions addressed in this case study are related to the intersections of pedagogy, modality, and content, with a specific focus on how these features of the first iteration of the project might be adjusted for future development. The following questions involve specific investigations of phenomena that emerge from the intersections of these three factors (as represented in Fig. 1: CPM Matrix).

1. Of the multimedia features built into this project, what aspects are most compelling to the participants and community?
    a. What features of the project add the most value to the learning experience for the participants?
    b. Did the participants spontaneously engage with certain features (e.g. YouTube videos), but not with others?

2. What was the attitude of the teachers towards the implemented technologies in the course?
    a. In what ways did the technologies diminish or promote the perceptions of content by the participants?
    b. Did the participants' attitudes towards the technologies and resources alter their motivational strength and metacognitive development?

   c. In what ways do the social media features of the design influence teachers' feelings of connectivity to a community of interest?

3. In what ways did the multimedia platform support teachers in incorporating the metacognitive learning process of the Legacy Cycle and neuroscience content into their own STEM classrooms?
   a. Based on the keystone projects developed by the participants, do the teachers have a sustainable and long-term plan for introducing the content and process to their students?
   b. In future follow-up interviews, will the participants exhibit a greater knowledge of neuroscience content and its implications for students?
   c. Will the teachers successfully engage their students' interest around neuroscience content throughout the school year?

Relevant Literature

This project's design is informed by three major literatures. First, the existing literature on reflective practices (Argyris, 1965; Schon, 1985) and a number of studies since the 1990s have confirmed the positive effects of these metacognitive practices in the context of professional development (e.g. CGTV the Jasper Project).(e.g., Biswas, Leelawong, Schwartz, & Vye, 2005; Lin, Schwartz, & Hatano, 2005. This is supported by research on the development of adaptive expertise (Hatano, 2005; Ericsson, 2007) and the Legacy Cycle itself. (use assessment work)

Second, the project's research and design methodologies parallel Barab, Thomas, Dodge, and Squire's Critical Design Ethnography (2004; also Barab, Dodge, Thomas, Jackson, and Tuzun, 2007). In this case, this project is an effort to transform a local context (the knowledge, practices, and values of teachers, students, and parents) while generating a blended multimedia instructional design pattern that can be reproduced in other contexts. This methodology comes attendant with the understanding that the process of designing, developing, implementing, and changing the program should be

seen as co-constructive between the stakeholders and designers. In an ideal world, this type of action research can uncover new ways of organizing and generating design parameters for learning communities in other contexts.

The approach is also supported by the current literature on Virtual Learning Communities (VLCs), a body of research that has directly informed the design of the web-based resources and in-person sessions for this course. In a Learning Sciences-oriented text on virtual communities, Riel and Polin (2004) articulate a distinction between three kinds of learning communities: Task-Based, Practice-Based, and Knowledge-Based communities. This particular project possesses qualities of both Practice-Based learning communities (where new practices are developed to solve community challenges, like the integration of neuroscience research into teaching practices), and Knowledge-Based communities (where the representation of community thought is a primary goal, as with the web resource). This perspective on the design of platforms for learning communities and activities would support the idea that a tightly-integrated platform should be used to ensure discussion, reflection, and uptake of new practices. Further, it would indicate that some form of interactive workspace (potentially in the form of a social networking platform) could help the community understand the value of the newly acquired knowledge.

Finally, based on the findings from the initial design and user-acceptance testing, this research team has decided to evaluate the project's blended implementation of technologies through the lens of Captology or Persuasive Technologies (Fogg, 2001). That is, the goal of the live course and the web-based resources is to change the behavior and thinking of its participants. The researchers will use a frameworks constructed from

Fogg (2001) and Porter (2008) to understand the degree and nature of the participants shifts in thought regarding the content. Researchers will use also use several qualitative and quantitative methods to examine the role of the technology in changing the thinking of the participants as part of a larger Design-Based Research initiative (Brown, 1992; Collins, Joseph, and Bielaczyc, 2004).

A Review of Extant Data From the First Iteration of *How Do I Learn?*

For the purposes of this assignment, the author would like to examine some of the earlier observations and collected data from our first iteration of the *How Do I Learn?* in-person seminar during August of 2012. During this five-day course, local middle school teachers were brought to the UW campus to learn about current findings in neuroscience. The course was designed to help the teachers understand how this knowledge might benefit their teaching, and how they might use this knowledge to excite their students about careers in neuroscience. In digging into the events of this course, we would like to use two key pieces of data to construct these observation notes: video-based interviews and classroom recordings, and records of the teachers' thought throughout the process. These data sets can provide insight into how teachers engaged with the content, how they see it influencing their teaching and thinking, and how they can pass this knowledge to their students.

Preliminary Observations from the Prototype and Initial Designs of the Neural Net:

Several features of the NeuralNet, web resources came to prominence during the initial design phase, and were identified as important design parameters regardless of the software platform selected for the final resource site. These included:

1. The importance of graphic organizers to help learners identify their location in the Master Challenges
2. A social network, forum, or other repository location is necessary to preserve the ideas, thinking, and resources generated by the participants throughout the Legacy Cycle. As Miel and Polin note, communities organized around knowledge usually form around the need to make external representation of that knowledge at the individual and group level.
3. A reflective journaling solution would be necessary to preserve participant thinking and support the Initial Thoughts and Small Group Discussions phases of the Legacy cycle.
4. The interactive component of the project should serve as a form of passive data collection for future quality-improvement and theoretical research, including the collection of representations of participants' thoughts, participant-discovered resources, and video of class discussions.
5. The web resource should also embrace the 'legacy' (e.g. passed-down over time) knowledge and thinking of previous iterations of the course by allowing future participants to view past records of participant thinking. Social networks and collaboratively-built resource archives may provide an avenue for preserving and expanding the community of knowledge created amongst participants.
6. The site should have the ability to make some resources available for public viewing, so that parents and students may benefit from the collected resources. Equally, some areas of the site should be password protected to guard the intellectual property of the participants. Personal journals should allow users to

'opt in' to sharing their thoughts when they are ready, but provide a private space for honest initial thoughts.

Video-based Data

Two brief interviews (two minute) were selected from the pool of five interviews for this analysis. Both interviews were conducted during the seminar's first day, as the class visited a brain lab in the University's biological sciences building. During the experience, teachers were given a one-hour lecture on parts of the brain drawn from real photographs. Then, the participants were allowed to handle human nervous system components (brains, spinal chords, etc.), and to dissect sheep brains with specialized tools according to printed instructions.

During this hands-on experience, researchers talked with "Carol," a 10th year middle-school science veteran who was intently matching segments of brain matter to names based on clues on a card. When asked about the experience, Carol noted that she felt that neuroscience and the brain are areas of content that her kids find very interesting, and that she hopes to revisit more frequently during her courses. She noted that it was hard to decide what to teach in these units, as so much of the field is conflicted. However, she felt that she was beginning to see opportunities for including brain-related content in other biological areas (including digestion, muscular-skeletal, and endocrine).

Later, researchers asked a five-year veteran teacher "Olga" to describe the experience, and what her students learned about neuroscience in her classes. She noted that students learned about the big ideas of human systems, including the circulatory system, digestive system, and a short unit on the nervous system. During their lessons on the digestive and circulatory systems, the teachers are able to provide frogs to the

students. However, she felt that they could never provide access to experiences that involve more complicated organisms, as their spending for science experiments amounted to a dollar-fifty per student per year. However, she was excited about the brain lab experience, because it gave her the opportunity to take pictures that she could use as resources in her class.

Finally, we have selected a video of the classroom presentations that formed the capstones of the seminar. During the last day of the course, the teachers (in groups of four) presented their plans for implementing the content in their classroom. In an unexpected turn, many of the groups of teachers had adopted the use of the anchored instruction cycle as a means of implementing the content in their own classes. It seems curious that these experienced teachers adopted this piece of pedagogical content knowledge, but one possible way of explaining this uptake is through the positive interactions of the teachers with this form of instructional design. The designers of the course oriented the course around this pedagogical model, and the phases of the anchored instruction cycle were made explicit to them throughout the course, along with the proposed benefits of using this methodology to order science experiences. Thus, the teachers may have had a positive perception of the cycle that made them more inclined to use it in their classroom. Further post-hoc interviews and upcoming observations during the PLCs will help to determine the continuing degree of this uptake in the months following the intervention.

Written Submissions of "Initial Thoughts" and "Revised Thoughts"

One of the unique features of this project was the twice-daily collection of data on participants' evolving thinking in the context of the class (as a component of the

anchored instruction cycle). At the beginning of the day, the instructors introduced the day's themes (neurology, sleep, attention, etc.), and asked the teachers to write down their thoughts on the theme (called Initial Thoughts or ITs). Then, after the day's presentations and working groups, the teachers again filled out a sheet for their Revised Thoughts (RTs), where the teachers would compare their Initial Thoughts against the ideas that they heard during the course of the presentations and activities. It may be possible to use this data to fine tune the course's content to match teachers' real-world concerns. This is an essential goal, as part of the project's grant requires that the neuroscience content relate directly to teachers' ability to use neuroscience findings to enhance their teaching and their students' learning.

In reviewing the IT/RT pages from the Sleep session (day 3, randomly chosen from the pile), it appears that teachers emerged from the day's lessons with two visible changes in thought that we might roughly classified as initial themes (derived from an initial Grounded Theory development process). First, a substantial number of teachers reported growing concerns regarding the effects of technology on their students sleep habits. This most likely resulted from the visiting lecturer's earlier discussion of issues related to light-exposure during the hours leading up to sleep. Specifically, the lecturer made several references to the fact that sleeping with cellphones nearby might make it difficult for younger people (the heaviest cellphone users) to give their eyes adequate time to signal their brain that it is time for sleep. This frequency of the teachers' references to technology-sleep issues is surprising, as the lecturer spoke for more than 90 minutes, across a variety of topics related to sleep, and few of the ITs mentioned

technology related issues before the lecture. This issue seemed to strike a chord with the teachers, and might be an important area for future professional development.

In addition to the sleep-and-technology theme, a number of teachers had IT questions directly related to the amount of sleep that is necessary for the maintenance of health. However, the day's RTs also indicated that many teachers came away from the discussion with the belief that the 'quality' of sleep had a greater impact on the individual's cognition than the number of hours spent sleeping. The teachers also made reference to the specific stages of sleep, and the importance of each stage, as the expert mentioned in his talk. This is interesting, as a number of teachers' ITs mention 'REM' sleep, but are vague about the meaning and relevance of this phenomenon to their students' intellectual development. The RTs from the same day appeared to show a greater understanding of sleep as a active and complex process, a theme that was also discussed by the expert during his talk. This way of framing the "Big Idea" of Sleep (as a systemic process that affects and enables learning, activity, healing, and growing – essentially all of the other systems of the body) may also prove beneficial in helping the teachers align this neuroscience content with the other systems-based biology content that they are currently teaching in schools. Further thinking in this area is ongoing.

Summary of Pre-Preliminary Findings

Ideally, this cursory examination of the evidence provides us with three early-stage lessons that can help advance the stakeholders' agendas in terms of the use of digital technologies. These technologies would ideally yield a suitable online program that captures and extends the content and experiences of the course. In the following summaries of potential lessons learned, the author would like to extend these lessons into

the realm of the ideal by providing a hypothetical vision for the projects' end-state. These include the following:

1) The teaching of neuroscience in classrooms is subject to real-world constraints and opportunity costs (competition with other content for airtime, expenses associated with materials) that require local interventions. In one imaginable scenario, the free, public version of the online course and upcoming PLCs will encourage teachers to continue finding value in the science, and energize parents to pressure the school's administration to allocate more funding for the necessary materials (e.g. sheep brains, dissection kits, media kits). However, many of the teachers took photos for use in their classroom, so it may be possible for the university to help alleviate this resource crunch through Adventure Learning-style lessons.
2) While a more extensive review of the material is on-going, the initial findings from the content-side of the IT/RT indicate that teachers are deeply concerned about the effects of media on adolescent cognition (several teachers wrote explicitly about this concern). Teachers also seemed to enjoy the interactive seminar experiences, and were greatly influenced by the experts' presentations.
3) Because of the strong uptake of the anchored instruction cycles, upcoming PLCs will involve the use of *poke-yoke* (Japanese, meaning 'fail-safing') webpage templates and resources that will enable teachers and students to develop their own instructionally sound anchored instruction cycles, and future interviews will assess this technological use.

Summary of Post-Course Feedback Surveys

Excerpts of Data From the Surveys About the Use of Legacy Cycle as a Learning Tool

High Praise from Teachers

"The information on the Challenge Cycle was the piece that is most helpful as it is the one that I can directly link and incorporate into my classroom."

"The challenge cycle will be a useful tool for my classroom. Although we already go through these steps, it is beneficial for students to have a formal approach that will be consistent through the content areas."

"The use of the Legacy Cycle as neuron-/brain-friendly way to approach my teaching practice and work with students."

Mixed Bags

"After the first three days I realized that this workshop was not about brain research as it relates to teaching. The workshop was about providing a teaching strategy in the form of the Challenge/Legacy Cycle and through that cycle, we were taught information about the brain. I think that to help the institute in the future it would be good to go back and decide what the actual focus of the week should be."

"I feel that if the diagram of the learning cycle were introduced earlier- perhaps tuesday - it would help to visualize the flow of that framework sooner. I plan to put it up in my classroom and I think that would have helped us too."

Critiques

"The Legacy Cycle is very similar to the 5E which we use in science classes...not sure if we need so much instruction on it"

"I would've liked to have seen a teacher/team/district...show examples of how they link neuroscience methods/The Challenge Cycle in their daily lesson plans, etc... and how it has shaped kid's learning, etc... (You can probably do this next year, as this was the first year doing this)."

Summary of Key Findings from Post-hoc Surveys

1. **Approximately 80 % of participants found The Legacy Cycle to be a valuable pedagogical strategy for participants in the course. 30 of the 35 teachers also specifically include this pedagogical strategy in their plans for teaching in their classrooms.** In addition to the valuable praise and critiques from the teachers, 80% of the 35 teachers chose to use the Anchored/Legacy Instruction cycle in their capstone project for the institute, which they will deliver in May of

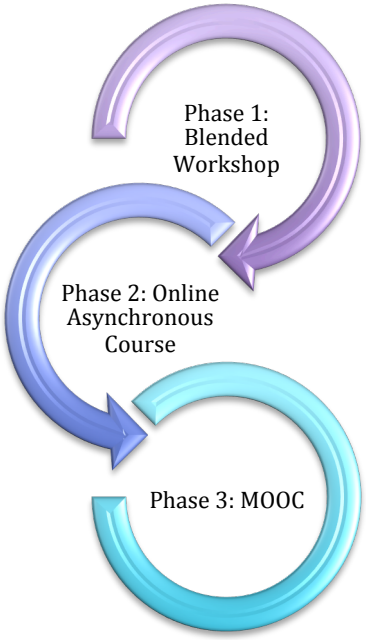
2013.

2. **Approximately 75% in the course suggested that additional support (case studies, examples, earlier introduction of the model, more clarification) would be helpful to understand the purpose and application of the Legacy Cycle**. These finding seem to indicate that the Legacy Cycle is not as intuitive to people as we might have thought, and we should help customers understand it value and the way in which it facilitates in the learning of a new subject. In some cases, teachers specifically requested more information on the process, and felt that it should be introduced as a scaffold earlier in the course.

3. **Some customers (12%) did not see the Legacy Cycle as a novel approach and claimed that they use other similar pedagogical strategies.** This finding indicates that some customers do not see the Legacy Cycle as an innovative or unique process/technology; therefore, they might not be compelled to pay for a class or product that uses Legacy as a core technology because they believe comparable substitutes are available.

Data Collection Plan

This data collection plan will help to support the development of an instructional design process for Massively Open Online Courses (MOOCs), a project requirement that has been added by stakeholders since the start of the project. This emerging model of free and accessible information will ideally allow learners to engage with high-quality content in a purely online space, and with thousands of co-participants. At present, however, the forms, features, and instructional design processes for these courses are up for grabs. It is this authors' instinct that quality, 'learning-ful' MOOC design may be most efficiently understood as an end-product that results from quality in-person courses.



In engaging with this problem through the *How Do I Learn* project and an adaptation of Doering, Veletsianos, Scharber, and Miller's (2009) Technological-Pedagogical-and-Content-Knowledge (TPACK) framework. Using this framework, we may be able to disentangle the relationships of content, pedagogy, and modality as the instructional system changes form over the coming year.

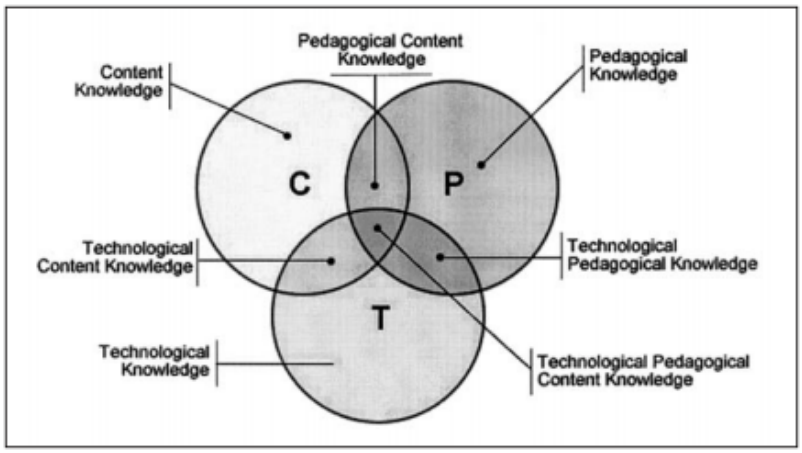


Figure 1. Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006).

This perspective is also ideal for communicating the successes and challenges to multiple stakeholders, as they are generally interested in two or more of these intersecting areas.

Phase 1: Live Course

The *How Do I Learn?* Summer Institute project has already yielded substantial data as it relates to the live, five-day version of the course. This data, cataloged in **Table 1**, has already provided formative information on the content, pedagogy, and modality (C/P/M) of the course. The bulk of the relevant research questions in this area come from the relationship of content and pedagogy, as well as the relationship of content and modality. These ideas will inform the project and provide information to the larger neuroscience education community.

Data Type	**Collection Period**	**Value to Future Iterations**
Community Design Meetings	March-June 2012	Conducted as a graduate class with Dr. Bransford, produced several initial iterations of content and modality, while exploring pedagogy
Teacher pre-course surveys	July 2012	Reveals some basic information about teachers' knowledge of neuroscience content, as well as interests in learning more
Video recordings from live course	August 2012	Contains content presentations by researchers in the field, group work sessions, and video/interviews during field trips to the Brain Lab
Teacher Keystone Project Plans	August 2012	Evidence of uptake as it stood at the end of the summer institute; plans for future action in their classrooms
Teacher Daily Reflection Assignments	August 2012	Daily snapshot of teacher refelections on content, pedagogy, and modality; may help to understand the learning

		process
Teacher Initial Thoughts and Revised Thoughts	August 2012	Valuable data on teachers' daily start and end knowledge each day; will provide data about the effectiveness of the pedagogical model

Table 1: Inventory of Extant Data

Phase 2: Online Course

Following on the heels of the first phase of development, the second phase will examine how the designers of the intervention continue to modify the content/pedagogy/modality of the project to suit a fully-online learning environment. This interstitial phase will serve to inform members of the AERA Brain, Neuroscience, and Education SIG at the 2013 meeting in San Francisco about findings related to neuroscience C/P/M. Further, it will result in a rolling online course and resource community for teachers who wished to participate in the Summer Institute, but who were unable to attend for practical reasons. This phase will simultaneously look backward at the lessons learned in Phase One, while looking forward to the Massively Open Online Course in Phase 3.

Table 2 summarizes the planned data collection for Phase 2. The bulk of this data will be collected during the month of February in 2013, as the online course prototype is expected to go-live and stay open for the duration of the month. The course will be hosted in Instructure's Canvas LMS. In contrast to existing 'resource websites,' this system has the advantage of allowing the researchers to passively collect a number of forms of user-generated data in the course of the learning process. This will further test a larger technological question about the relationship of modality and pedagogy as the project is transformed from an in-person experience to an online community experience.

This is a known process, but a crucial step in the continued development of a MOOC-style course.

Data Type	Collection Period	Value to Future Iterations
Online course prototype	November 2012-February 2013	TBD
Teacher pre-course surveys	February 2013	TBD
Teacher End of Module Reflection Assignments	February 2013	TBD
Teacher Initial Thoughts and Revised Thoughts	February 2013	TBD
Demographic survey	February 2013	TBD
End of course evaluation feedback	March 2013	TBD
Community-based resources for neuroscience teaching		TBD

Table 2: Data collection for phase two

Table 3 summarizes the PLC data collection plans for the November 2012 – May 2013 period. This data will include artifacts from the document storage site Wiggio (where teachers will upload their assignments, materials, and shared files), as well as monthly 1-hour webinars hosted by the Puget Sound Educational Services District Staff. These

PLCs will contain

Date	Type of Webinar	Webinar Topic
November 13 2012 (***collected***)	PLC	PLC Overview and Challenge-based Learning Cycle
December 11, 2012	PLC	Adolescent Brain Basics
January 8, 2013	Public PLC	Adolescent Brain and Technology
February 12, 2013	PLC	TBD by Cohort
March 12, 2013	Public and PLC	Adolescent Brains, Emotions, and Learning

April 9, 2013	PLC	TBD by Cohort
May 14, 2013	PLC	Sharing Strategies and Results

Phase 3: Massively Open Online Course

A number of stakeholders have expressed an interest in promoting the content of the course through the development of a MOOC-style course. This is an admirable goal, but it is clear from the practitioner-oriented literature that the differences between design parameters for online courses (well-understood in the literature) and for MOOCs (a new and emerging technology) are not fully understood. Thus, this phase is somewhat hazy, as the researchers have not yet interacted with the Coursera MOOC software. In short, unknown-unknowns abound in this area. **Table 4** represents an early effort to identify potential data-sources in the miasma of probability.

Data Type	**Collection Period**	**Value to Future Iterations**
LMS-to-MOOC prototype process	February-June, 2013	TBD
Course analytics	April-June, 2013	TBD
Online community's initial thoughts and revised thoughts	April-June, 2013	TBD
Peer-reviews of IT/RT	April-June, 2013	TBD
Forum interactions	April-June, 2013	TBD
Quizzes and knowledge checks	April-June, 2013	TBD

Scholarly Significance

This project is relevant to three areas of current academic research. First, the project itself has the potential to inform practices and content for other programs that seek to help teachers, students, and parents make use of Neuroscience research in their daily lives and future careers. Second, the design of the online environment may guide future design decisions for online resources and websites for teacher professional

development. Finally, the research methods themselves may yield further ideas for how to effectively design metacognitive communities in multiple, learning and professional development contexts.

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