Project Title: **ENRTF ID:** **088-C**

Educational Game about Water Quality in Minnesota Lakes

Category: C. Environmental Education

Total Project Budget: $ 313,000

Proposed Project Time Period for the Funding Requested: 2 years, July 2017 – June 2019

Summary:

University of Minnesota faculty and Andamio Games will collaborate to create "Lake Doc," a collaborative and educational game for high-school students and museum-going members of the general public.

Name: Sehoya   Cotner

Sponsoring Organization: U of MN

Address: 420 Washington Ave SE, 3-154 MCB

       Minneapolis   MN   55455

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

A vision for the Lake Doc main menu, along with a project work flow for game creation.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: *Educational game about water quality in Minnesota lakes*

I. PROJECT STATEMENT

What? University of Minnesota faculty, in collaboration with locally based Andamio Games, the new (in 2018) Bell Museum of Natural History, and high-school educators, will create a free educational game ("Lake Doc") for mobile devices that is suitable for high-school students and museum-going members of the general public. Lake Doc will teach, using data collected by University faculty and a collaborative gaming technique developed by Andamio, the underlying scientific factors that impact lake health, and steps scientists and citizens can take to address conservation challenges.

Why? The recent Governor's Water Summit[1] highlighted the fact that pollution in Minnesota's lakes has reached an alarming level, and emphasized the need for meaningful mitigation. The success of these efforts ultimately rests with every individual in Minnesota. Public understanding of the root causes of these threats, however, is severely lacking. Lakes are complex ecosystems subject to a variety of impacts. Thus, mitigating problems requires an understanding not only of these complex dynamics, but also the stakeholders involved in decision-making. Collaborative gaming is an effective way to engage individual in learning about these locally relevant and complex ecosystems, stakeholders, and mitigation strategies. **How?** We will draw on our scientific backgrounds (U of MN faculty), technological innovations (Andamio), and educator networks to accomplish the following **goals:** (1) create a collaborative mobile-device application that will gamify important aspects of the natural history of lakes-- lake origin, human impacts, stakeholder interests, and potential solutions to problems; and (2) distribute the application and evaluate its impacts on project **outcomes.** Specifically, we will measure whether game participants are able to: (1) Articulate several variables that influence lake characteristics; (2) Describe the impact of various human activities on lakes; (3) Develop skills that enable ecologically sound management; and (4) Demonstrate greater knowledge of, and interest in, the status of their local lake habitats. The game, available as a free app online, will make it easy for teachers to include lake ecology as part of their regular curriculum, and for museum visitors to engage in secondary reinforcement of the information provided at the museum. Moreover, the game will integrate seamlessly into Andamio's existing offerings, making it easy to implement in schools.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Create Lake Doc, a freely available, collaborative mobile application for learning about lake ecosystems, human impacts, and conservation. **Budget: $261,000**

Andamio Games is a Minnesota-based small business developing mobile device-based instructional tools that enable educators to meet standards, advance their students' comprehension of essential science subjects, and improve their students' performance on standardized tests. This project will leverage Andamio's Framework for Originating Responsive Game-based Education (FORGE) tools and their patented[2] collaborative learning approach to develop this locally and ecologically relevant educational game. University of Minnesota faculty members and students will collaborate with Andamio staff to write appropriate science content for the game (e.g. what is an ecosystem? How are lakes and terrestrial environments intertwined?) that is aligned with state science standards and relevant to Minnesota conservation challenges.

Outcome	Completion Date
1. Lake Doc ready for pilot, in response to teacher and student feedback	August 2018

Activity 2: Distribute Lake Doc to schools and museums statewide **Budget: $52,000**

Lake Doc will be distributed for free to Minnesota's approximately 290 middle schools and 700 high schools using Andamio's established internet presence (website and App stores) and current distribution methods

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[1] https://mn.gov/governor/issues/governors-water-summit/

[2] US Patent #9,111,458

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(teacher outreach through statewide conferences; meetings with school and district level curriculum and instruction), and through coordination with state conservation groups and youth fishing organizations in Minnesota. In consultation with informal education institutions, we will also modify the full school version to make the game challenges suitable for participating museums and nature centers. The evaluation effort will involve application analytics, focus groups with participating teachers, and pre- and post-surveys of participating students to evaluate content acquisition and student engagement.

Outcome	Completion Date
1. Lake Doc pilot in 2-3 area schools and the Bell Museum of Natural History	June 2018
2. Full-scale game rollout and evaluation in schools and museums	June 2019

III. PROJECT STRATEGY
A. Project Team/Partners

Individual	Receiving ENRTF funds?	Affiliation	Role
Sehoya Cotner, PhD	No	U of MN	Project coordinator
Adam Gordon	Yes	Andamio Games	Director of Andamio, coordinates personnel
James Cotner, PhD	Yes	U of MN	Scientific consultant (limnology)
Seth Thompson, MS	Yes	U of MN	Day-to-day liaison between Andamio and U of MN, assessment lead
Martin Michalowski, PhD	Yes	Andamio Games	Technology lead
Hazel Shackelton	Yes	Andamio Games	Software developer
Katrina Schleisman, PhD	Yes	Andamio Games	Instructional Designer
Nelson Soken, PhD	Yes	Andamio Games	Game design and usability
August Schwerdfeger, PhD	Yes	Andamio Games	Simulator engineer

We request $102, 376 for University costs, and $200,000 for Andamio's participation.

B. Project Impact and Long-Term Strategy
After the Bell Museum and metro-area schools pilot, we plan to broaden our reach via informal science education colleagues at locations such as the Great Lakes Aquarium in Duluth and the Science Museum of Minnesota. Our goal is to eventually reach a statewide network of educators and museum-going citizens. We also see opportunities for related games, such as one centered on the challenge of aquatic invasive species. Lake Doc responds to LCCMR's "Environmental Education" **funding priority** by increasing the knowledge and skills of students and state citizenry to (a) understand the complexity of factors influencing lake health, (b) balance the demands of different stakeholders in discussing management priorities; and (c) become educated about challenges and solutions impacting Minnesota's lakes. This effort will be locally led, involves broad-based partnerships between the University, Andamio Games, area educators, and informal science-education leaders, and is committed to building a life-long and action-based conservation ethic in its participants. Lake Doc will deliver **multiple benefits** by engaging educators and their students in realistic discussions about the complexities of lake ecosystems, and the challenges of protection, sustainable use, and management. The **extent of impacts** covers the entire state and possibly more, as the game will be disseminated through the Apple AppStore (as a free app) and the existing networks of Andamio Games and S. Cotner, and will be targeted at biology and environmental-science teachers throughout Minnesota.

C. Timeline Requirements: July 2017-June 2019 (two years)

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2017 Detailed Project Budget

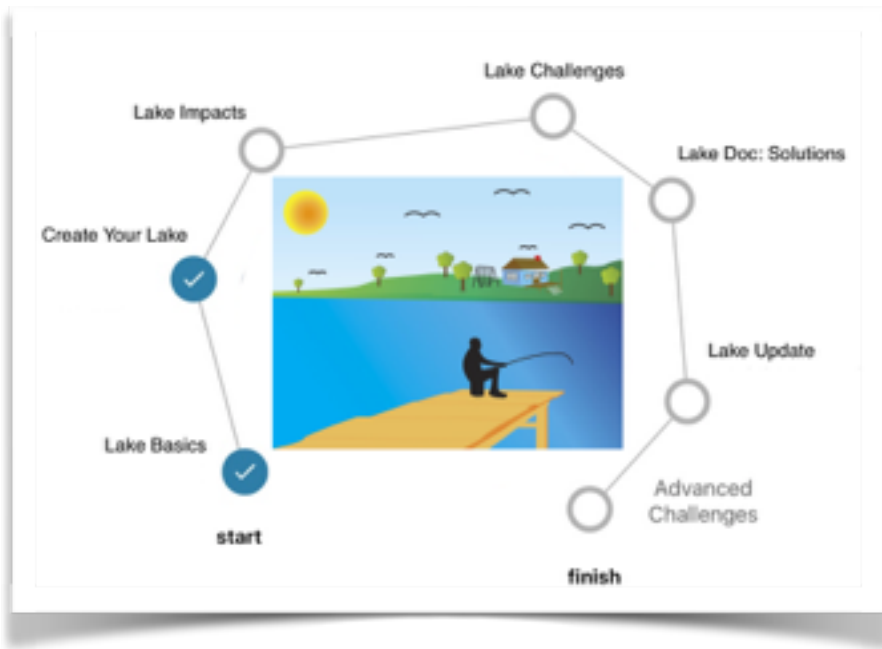**Project Title: Lake Doc -- a STEM game for Minnesota lakes**

IV. TOTAL ENRTF REQUEST BUDGET *2* years

BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	AMOUNT
Personnel:	
James Cotner, Co-PI (75% salary, 25% fringe benefits); Year 1 = 1 summer month. Salary is requested for mentorship of the graduate student and data assistance during development of the simulator.	$16,000
Graduate Student (52% salary, 48% fringe benefits during the academic year -includes tuition) (85% salary, 15% fringe benefits during the summer); 50% FTE for years 1 & 2	$ 94,000
Professional/Technical/Service Contracts: *Andamio Games will generate a curriculum-based ontology for creating the game and underlying simulator. Andamio personnel will also develop graphics and link the game to their existing Teacher Dashboard.*	$ 200,000
Travel:*In-state travel during pilot and full-scale rollout of game.*	$ 2,000
Additional Budget Items:*Honoraria for teachers participating in initial focus group and pilot. 6 teachers x $100 = $600*	$ 1,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST	$313,000

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

| SOURCE OF FUNDS	AMOUNT	Status
In-kind Services To Be Applied To Project During Project Period: *U of MN Indirect costs (53% MTDC in FY18, 54% MTDC in FY19) associated with this proposal; Andamio Games in-kind contributions to the project would include: Publicity through current marketing channels (website, social media, Minnesota science teacher organizations like MnCOSE, TIES, SciMathMN, Ignite Afterschool); Educator access to development tools for language customization (e.g., Spanish, Somali); Making the game freely accessible through the Andamio Games Teacher Dashboard, which provides support to teachers for classroom implementation*	$ 146,000	*Secured*
Remaining $ From Current ENRTF Appropriation:*N/A*	$ -	*Indicate: Unspent? Legally Obligated? Other?*

a.

b.

Creating "Lake Doc," an interactive educational game for mobile devices. Lake Doc will build on existing tools developed and patented by Andamio Games, but incorporating current research and authentic data from U of MN researchers studying Minnesota's lakes.

a. A vision of the Lake Doc main menu.
b. Students work together, with teacher feedback, on a existing collaborative Andamio game (iNeuron).
c. Development will involve the following steps:
   i. Build Lake Health Knowledge Base
   ii. Design Lake Health Lesson Plans, aligned with Minnesota Science Standards
   iii. Generate Game Interactions
   iv. Create the Lake Simulator
   v. Develop Mobile Applications
   vi. Iterate and Test with School and Museum Educators (throughout the process)
   vii. Expand to a statewide audience of educators and museum collaborators

c.
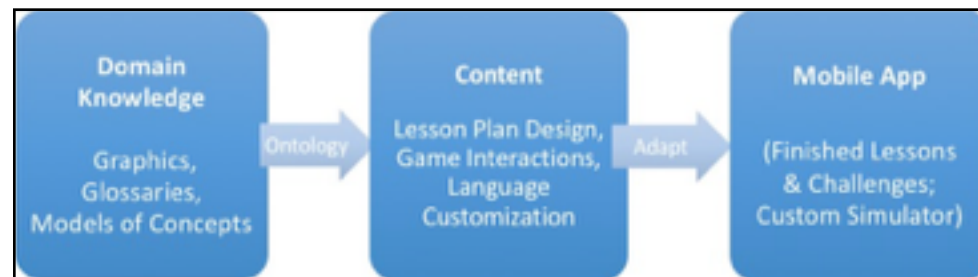
PROJECT TITLE: *Lake Doc* -- a STEM game for Minnesota lakes

Project Manager Qualifications and Organization Description

Project Manager: Dr. Sehoya Cotner, Associate Professor, Department of Biology Teaching and Learning, 3-154 Molecular and Cellular Biology Building, 420 Washington Avenue SE, Minneapolis, MN 55455, sehoya@umn.edu

Organization Description: University of Minnesota, Twin Cities Campus; Research, education, and outreach institution serving the state of Minnesota.

Project Responsibilities: Will oversee all activities, and coordinate the efforts of University personnel (faculty and graduate students) and Andamio Games, the professional organization that will develop the software described in the current proposal.

Research Interests: Developing science skills in members of the general public, course-based research experiences, and using technology in education.

Specific Qualifications: I currently collaborate with Andamio personnel to create "Cyto-Assist," a multi-user game to assist with learning about photosynthesis and cellular respiration. Positive experiences with Andamio, and the recent initiatives to improve water-quality awareness in Minnesota, led to the development of this Lake Doc proposal. I have been involved with several educational outreach events at area schools (via a "Traveling Touch Tank," created by U of MN marine-biology students to educate people about marine ecosystems and conservation) and museums (e.g. "The Tournament of Kitchen Utensils," a kinetic game to simulate natural selection at The Science Museum of Minnesota, various presentations at the Bell Museum of Natural History), and have a history of technology integration (flipping the classroom, classroom-response devices, student-generated video podcasts, etc.) in educational settings. My research interests, leadership experiences, and collaborative networks ensure the success of this proposal.

Education:
B.S.	North Carolina State University Biological Sciences	1992
Ph.D.	University of Minnesota Conservation Biology	1999