

**U.S. Department of Education - EDCAPS
G5-Technical Review Form (New)**

Status: Submitted

Last Updated: 08/09/2021 06:54 PM

Technical Review Coversheet

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Reader #1: *****

	Points Possible	Points Scored
Questions		
Selection Criteria		
Significance		
1. Significance	15	8
Sub Total	15	8
Strategy to Scale		
Strategy to Scale		
1. Strategy to Scale	20	16
Sub Total	20	16
Selection Criteria		
Quality of Project Design		
1. Project Design	20	12
Adequacy of Resources		
1. Quality of the Management	20	17
Quality of the Project Evaluation		
1. Project Evaluation	25	
Sub Total	65	29
Priority Questions		
CPP1		
Computer Science		
1. Computer Science	5	0
Sub Total	5	0
Total	105	53

Technical Review Form

Panel #2 - EIR Mid-Phase - 2: 84.411B

Reader #1: *****

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Questions

Selection Criteria - Significance

1. The Secretary considers the significance of the proposed project. In determining the significance of the proposed project, the Secretary considers the following factors:

Reader's Score: 8

Sub

1. (1) The national significance of the proposed project.

Strengths:

The applicants provide a rationale for the need to improve understanding of how kids engage in Game Based Learning ("GBL"), increasing use of more sophisticated GBL in school-based settings, and use of GBL as an instructional practice (p. E17) which considering the recent worldwide pandemic could have substantial significance for student engagement in technology-based versus traditional classroom-based settings.

Weaknesses:

The applicants did not address the context of GBL with high needs students, existing empirical evidence for Mission HydroSci ("MHS") with this specific population, and why the proposed MHS system would address underlying educational challenges within these populations which minimizes the potential national significance of the project.

Reader's Score:

2. (2) The potential contribution of the proposed project to increased knowledge or understanding of educational problems, issues, or effective strategies.

Strengths:

The applicants propose to address the educational problem by implementing Mission HydroSci (MHS) with a minimum of 7,000 students in grades 6-8 including high-needs populations (e.g., at-risk for science failure due to poverty, attending minority schools or disengagement from science; p. E14). MHS is a 3D GBL environment that proposes to replace 6 to 8 class sessions which address general and earth science. The MHS game integrates components (e.g., gaming, 3D virtualization, empirical learning progressions, scaffolding, and empirically grounded instructional) to increase engagement in science learning (p. E17). This study of the proposed GBL approach as a strategy to address the identified educational problem would likely contribute to the field.

Weaknesses:

It is unclear what the existing evidence base is for the MHS game. The applicants mention being developed as an i3 project, but do not provide any outcomes data to convey moderate evidence in targeted outcomes between those who accessed MHS and those in BAU. There is no direct connection as to why the proposed MHS would address the educational science outcomes of the high-needs populations they proposed to study. Each population likely has

Sub

an empirical literature base which documents difficulties with science and STEM education. This information would have strengthened the proposal conveying the ability of MHS to address ongoing educational problems and effectiveness in closing the gaps for both increasing GBL in school settings and improving science related outcomes for high-needs populations.

Reader's Score:

Strategy to Scale - Strategy to Scale

- 1. The Secretary considers the applicant's strategy to scale the proposed project. In determining the applicant's capacity to scale the proposed project, the Secretary considers the following factors:**

Reader's Score: 16

Sub

- 1. (1) The extent to which the applicant identifies a specific strategy or strategies that address a particular barrier or barriers that prevented the applicant, in the past, from reaching the level of scale that is proposed in the application.**

Strengths:

The applicants present proposed barriers to scaling in three primary areas which are further explained in detail on pp. E25-30. For each presented barrier, the applicants explicitly address how they will overcome this barrier both with a practical approach and backed by empirical support. For example, in barrier one, the need for ongoing monitoring of standards/curriculum alignment as well as coordinated assessments (pp. E25-26), the applicants convey why addressing the barrier is important for scaling (e.g., academic success for students and buy-in/implementation by teachers), along with how they propose to remove the presenting barrier (e.g., aligning standards to NGSS, accessing a set of CICs to have ongoing testing and refinement occurring in order to work more closely with the end-users to create an efficient product; p. E26). This similar approach is applied for each of the four barriers, easily connecting a presenting barrier to both application in and empirically, conveying that when each solution is combined as one cohesive plan, the applicants will likely have success in overcoming barriers to reach scale.

Weaknesses:

It is unclear how these barriers were noted or documented in the previous study of MHS. It would have strengthened the application to understand what challenges were faced and why the identified barriers prevented scale. Understanding these aspects would have really strengthened the rationale for the applicants' proposed approach to addressing the original barriers to scaling MHS.

Reader's Score:

- 2. (2) The mechanisms that applicant will use to broadly disseminate information on its project so as to support further development or replication.**

Strengths:

The applicants provide a well thought out dissemination plan for the MHS project. This includes presenting actionable dissemination plans for each of the MHS stakeholders (pp. E30-32). The applicants propose to address dissemination among researchers, educational game developers, science teachers, and district administrators (pp. E30-31). The core MHS team have a documented history of dissemination and well-established outlets to reach the research, policy, and broad education sectors (pp. E62-76).

Sub

Weaknesses:

The application would have been strengthened by providing some context as to how the previous MHS findings were disseminated and if this approach was deemed successful. Given that the project was completed relatively recently (2018; p. E64), dissemination efforts of this work are likely still ongoing. Therefore, specifically understanding which specific outlets were used, who were the targeted stakeholders, and how this supported future scaling opportunities of MHS would have strengthened the proposal.

Reader's Score:

Selection Criteria - Quality of Project Design

- 1. The Secretary considers the quality of the design of the proposed project. In determining the quality of the design of the proposed project, the Secretary considers the following factors:**

Reader's Score: 12

Sub

- 1. (1) The extent to which there is a conceptual framework underlying the proposed research or demonstration activities and the quality of that framework.**

Strengths:

Although not explicitly referred to as the conceptual framework, the applicants do present some context as to how the MHS system builds from extensive research around water systems and the inclusion of learning progressions focused on argumentation (p. E22). This encourages users to engage in reasoning around science concepts. Furthermore, the applicants discuss the importance of the integration of Learning Analytics into MHS to promote continuous improvement as well as increased learning and engagement (p. E22). These elements seem fundamentally linked to how MHS was conceptualized from the inception.

Weaknesses:

There is no specific mention of an MHS conceptual framework in the narrative, no reference to the appendices or how the curriculum development was guided by a theoretical basis or framework. The proposal would have been strengthened by providing specific details on what conceptual basis influenced the design work of MHS. For example, providing context as to why the MHS GBL platform is structured in a certain manner, why particular content was included or excluded to reach the target population, the reasoning behind selecting the elements integrated into MHS. Providing a bit of context in the application would have helped to connect some of these elements and strengthen the foundation for the MHS conceptual framework.

Reader's Score:

- 2. (2) The extent to which the goals, objectives, and outcomes to be achieved by the proposed project are clearly specified and measurable.**

Strengths:

The applicants present a plan scaling MHS which is related to areas of platform expansion, MHS access, dissemination, and large-scale testing. The applicants present a detailed plan (pp. E18-20) to address the identified barriers which include measurable outcomes. The plan is linear and each objective builds onto the next so that by the end of the project the applicants propose to have a fully developed MHS intervention that can be taken to scale (pp. E18-20).

Sub

Weaknesses:

It would have been helpful to see a timeframe associated to Exhibit 1 (p. E18) to gauge if the proposed goals and objectives can be achieved. It is unclear how much time it takes to optimize, update, and test new systems within MHS. Understanding this essential information would have helped to determine if the presented goals and objectives can be reasonably achieved as proposed.

Reader's Score:

- 3. (3) The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs.**

Strengths:

The applicants present some qualitative data from previous participants of the MHS study to convey how MHS addressed student needs (e.g., engagement, leadership, and interest; pp. E19-20). There is also some empirical support presenting the need to improve motivation for science education in middle school students (p. E20) along with how aligning MHS to curriculum standards can accomplish both engagement and science related outcomes for middle school students (p. E20).

Weaknesses:

The concern pertaining to this factor links back to understanding the empirical literature base around needs of the target populations. The target populations are hardly mentioned in the application, outside of the abstract. There is no empirical support of how MHS worked with these populations in the previous study. It is not explicitly stated why the selected elements of MHS (e.g., LA, argumentation, learning progressions, social interactions, gaming, 3D; p. E17) are integrated in such a way that they will provide the optimal solution to address the educational needs and outcomes of the high needs populations identified on p. E14. Some background information about the populations, associated characteristics, and outcomes for each would have helped to strengthen the application and convey that the MHS gaming system will address the needs of the targeted high needs populations.

Reader's Score:

Selection Criteria - Adequacy of Resources

- 1. The Secretary considers the adequacy of resources and the quality of the management plan for the proposed project. In determining the adequacy of resources and quality of the management plan for the proposed project, the Secretary considers the following factors:**

Reader's Score: 17

Sub

- 1. (1) The applicant's capacity (e.g., in terms of qualified personnel, financial resources, or management capacity) to bring the proposed project to scale on a national or regional level (as defined in 34 CFR 77.1(c)) working directly, or through partners, during the grant period.**

Strengths:

This proposed project includes a comprehensive team encompassed by experts in research, technology design, implementation, and evaluation (p. E32). The MHS team has conducted successful development and evaluation work of the original MHS program (p. E32) and appear well-staffed to bring the current project to scale (pp. E32-33). The applicants also provided a detailed timeline of activities (pp. E35-36) and letters of support from participating school districts, evaluators, and key project contributors to further convey support for how the project will be

Sub

completed and scaled.

Weaknesses:

No weaknesses identified.

Reader's Score:

2. (2) **The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.**

Strengths:

There is a detailed management plan present (pp. E35-36) which outlines specific objectives that will be met, along with timeframes (in years) under which these will be met, and the individuals who are responsible for seeing objectives through to completion. This also reflects broad timelines, individual responsible, and ongoing status. Generally, the timelines can be adequately measured, and are aligned to the larger project goals and objectives.

Weaknesses:

There were some elements of the management plan that were vague (pp. E35-26). Similar to the feedback presented in C.2, it would have helped to really see specific timeframes associated with technology development, refinement, beta-testing, and additional refinement to better understand how this relates to the feasibility of carrying out other project goals. An additional area that is unclear is when dissemination will occur of project findings. This would seem integral to scale and recruiting additional sites for even future years within the proposed project. These specific details added to the timeline would provide additional strength to the overall management plan and likely help achieve proposed project goals.

Reader's Score:

3. (3) **The extent to which the costs are reasonable in relation to the objectives, design, and potential significance of the proposed project.**

Strengths:

The budget narrative for each participating entity provides a breakdown of costs associated to FTE, benefits, direct and indirect costs as well as participant stipends (pp. E162-173). The applicants make the case that the MHS platform is cost effective for schools, but the refinement offered in this proposal will allow for even greater cost savings with a comprehensive curriculum and assessment approach built into the upgraded, more efficient technology (p. E35). The applicants also present a series of strategies to sustain funding beyond the life of this proposed research funding (p. E35). Collectively, these costs appear reasonable in relation to the objectives, design, and potential significance of the proposed project.

Weaknesses:

The application would have been strengthened by providing some context or evidence surrounding the cost models or analysis that were used in the prior MHS study. This information would have helped to convey the reasonableness of the costs relative to the objectives, design, and potential significance of this proposed project.

Reader's Score:

Selection Criteria - Quality of the Project Evaluation

1. **The Secretary considers the quality of the evaluation to be conducted of the proposed project. In determining the quality of the evaluation, the Secretary considers the following factors:**

Reader's Score:

Sub

1. (1) The extent to which the methods of evaluation will, if well implemented, produce evidence about the project's effectiveness that would meet the What Works Clearinghouse standards without reservations as described in the What Works Clearinghouse Handbook (as defined in 34 CFR 77.1(c)).

Strengths:

Weaknesses:

Reader's Score:

2. (2) The extent to which the evaluation will provide guidance about effective strategies suitable for replication or testing in other settings.

Strengths:

Weaknesses:

Reader's Score:

3. (3) The extent to which the evaluation plan clearly articulates the key project components, mediators, and outcomes, as well as a measurable threshold for acceptable implementation.

Strengths:

Weaknesses:

Reader's Score:

Priority Questions

CPP1 - Computer Science

1. Projects designed to improve student achievement or other educational outcomes in computer science (as defined in this notice). These projects must address the following priority area: Expanding access to and participation in rigorous computer science coursework for traditionally underrepresented students such as racial or ethnic minorities, women, students in communities served by rural local educational agencies (as defined in this notice), children or students with disabilities (as defined in this notice), or low-income individuals (as defined under section 312(g) of the Higher Education Act of 1965, as amended).

Strengths:

N/A, this proposal does not include a computer science competitive preference design component.

Weaknesses:

N/A, this proposal does not include a computer science competitive preference design component.

Reader's Score: **0**

Status: Submitted
Last Updated: 08/09/2021 06:54 PM

Status: Submitted

Last Updated: 08/06/2021 10:05 AM

Technical Review Coversheet

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Reader #2: *****

	Points Possible	Points Scored
Questions		
Selection Criteria		
Significance		
1. Significance	15	
Sub Total	15	
Strategy to Scale		
Strategy to Scale		
1. Strategy to Scale	20	
Sub Total	20	
Selection Criteria		
Quality of Project Design		
1. Project Design	20	
Adequacy of Resources		
1. Quality of the Management	20	
Quality of the Project Evaluation		
1. Project Evaluation	25	21
Sub Total	65	21
Priority Questions		
CPP1		
Computer Science		
1. Computer Science	5	
Sub Total	5	
Total	105	21

Technical Review Form

Panel #2 - EIR Mid-Phase - 2: 84.411B

Reader #2: *****

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Questions

Selection Criteria - Significance

1. The Secretary considers the significance of the proposed project. In determining the significance of the proposed project, the Secretary considers the following factors:

Reader's Score:

Sub

1. (1) The national significance of the proposed project.

Strengths:

Weaknesses:

Reader's Score:

2. (2) The potential contribution of the proposed project to increased knowledge or understanding of educational problems, issues, or effective strategies.

Strengths:

Weaknesses:

Reader's Score:

Strategy to Scale - Strategy to Scale

1. The Secretary considers the applicant's strategy to scale the proposed project. In determining the applicant's capacity to scale the proposed project, the Secretary considers the following factors:

Reader's Score:

Sub

1. (1) The extent to which the applicant identifies a specific strategy or strategies that address a particular barrier or barriers that prevented the applicant, in the past, from reaching the level of scale that is proposed in the application.

Strengths:

Weaknesses:

Reader's Score:

2. (2) The mechanisms that applicant will use to broadly disseminate information on its project so as to support further development or replication.

Strengths:

Weaknesses:

Reader's Score:

Selection Criteria - Quality of Project Design

1. The Secretary considers the quality of the design of the proposed project. In determining the quality of the design of the proposed project, the Secretary considers the following factors:

Reader's Score:

Sub

1. (1) The extent to which there is a conceptual framework underlying the proposed research or demonstration activities and the quality of that framework.

Strengths:

Weaknesses:

Reader's Score:

2. (2) The extent to which the goals, objectives, and outcomes to be achieved by the proposed project are clearly specified and measurable.

Sub

Strengths:

Weaknesses:

Reader's Score:

- 3. (3) The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs.**

Strengths:

Weaknesses:

Reader's Score:

Selection Criteria - Adequacy of Resources

- 1. The Secretary considers the adequacy of resources and the quality of the management plan for the proposed project. In determining the adequacy of resources and quality of the management plan for the proposed project, the Secretary considers the following factors:**

Reader's Score:

Sub

- 1. (1) The applicant's capacity (e.g., in terms of qualified personnel, financial resources, or management capacity) to bring the proposed project to scale on a national or regional level (as defined in 34 CFR 77.1(c)) working directly, or through partners, during the grant period.**

Strengths:

Weaknesses:

Reader's Score:

- 2. (2) The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.**

Strengths:

Sub

Weaknesses:

Reader's Score:

3. (3) The extent to which the costs are reasonable in relation to the objectives, design, and potential significance of the proposed project.

Strengths:

Weaknesses:

Reader's Score:

Selection Criteria - Quality of the Project Evaluation

1. The Secretary considers the quality of the evaluation to be conducted of the proposed project. In determining the quality of the evaluation, the Secretary considers the following factors:

Reader's Score: 21

Sub

1. (1) The extent to which the methods of evaluation will, if well implemented, produce evidence about the project's effectiveness that would meet the What Works Clearinghouse standards without reservations as described in the What Works Clearinghouse Handbook (as defined in 34 CFR 77.1(c)).

Strengths:

The proposal is an RCT and therefore could meet WWC standards without reservations. The evaluation method is presented very clearly, with many of the important concerns about RCT validity being addressed in a credible way (e.g., potential confounding is discussed in detail (p. e40), attrition is considered carefully (pp. e39-40, e43), sample sizes are good (p. e38), and the power of the analysis is derived correctly (p. e38 and Appendix J6).

Weaknesses:

There are some minor concerns. One concern is that parental consent may also be an issue for the control group class. Also, the cost-effectiveness analysis (CEA) discussion (p. e43) should be developed more. For these types of computerized interventions, the time in class is not the significant cost; it is the development cost and the materials cost (getting the computers/devices to the students). The proposal would be strengthened if these costs were discussed.

Reader's Score:

2. (2) The extent to which the evaluation will provide guidance about effective strategies suitable for replication or testing in other settings.

Sub

Strengths:

The replicability or scaling is powerful because many teachers are facing challenges over the use of computerized education; the proposal indicates a set of clear teacher-related guidance information guides (p. e44). And the intervention is not very expensive and covers material that many middle school students need. The use of post-intervention interviews to help with replication is a good idea (p. e44); and the fidelity of implementation study is well-motivated.

Weaknesses:

There is one weakness: the students served may not be high-need. Teacher random assignment may mean that all students may receive the intervention, regardless of their need or individual characteristics.

Reader's Score:

3. (3) **The extent to which the evaluation plan clearly articulates the key project components, mediators, and outcomes, as well as a measurable threshold for acceptable implementation.**

Strengths:

: The intervention is investigated in detail. The sample size is sufficient. The power of the test calculation is strong and well-founded (pp. e38-39). The discussion of the moderators is clear and well-justified (p. e45).

Weaknesses:

There are only modest weaknesses. Given random assignment is at the teacher-level, the proposal might be strengthened if more attention was paid to teacher processes and the willingness of teachers to participate. Teachers are critical mediators; more discussion of their role (and mediators such as their experience) would strengthen the proposal.

A second concern relates to outcomes: the intervention is so brief that it may have no long-term effect. The proposal would be stronger if fade-out was given more attention (the intervention can be assessed with <50 multiple-choice questions (p. e43), suggesting the knowledge/skills acquired may not be substantial).

Reader's Score:

Priority Questions

CPP1 - Computer Science

1. **Projects designed to improve student achievement or other educational outcomes in computer science (as defined in this notice). These projects must address the following priority area: Expanding access to and participation in rigorous computer science coursework for traditionally underrepresented students such as racial or ethnic minorities, women, students in communities served by rural local educational agencies (as defined in this notice), children or students with disabilities (as defined in this notice), or low-income individuals (as defined under section 312(g) of the Higher Education Act of 1965, as amended).**

Strengths:

Weaknesses:

Reader's Score:

Status: Submitted

Last Updated: 08/06/2021 10:05 AM

Status: Submitted

Last Updated: 08/05/2021 09:45 PM

Technical Review Coversheet

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Reader #3: *****

	Points Possible	Points Scored
Questions		
Selection Criteria		
Significance		
1. Significance	15	0
Sub Total	15	0
Strategy to Scale		
Strategy to Scale		
1. Strategy to Scale	20	0
Sub Total	20	0
Selection Criteria		
Quality of Project Design		
1. Project Design	20	0
Adequacy of Resources		
1. Quality of the Management	20	0
Quality of the Project Evaluation		
1. Project Evaluation	25	19
Sub Total	65	19
Priority Questions		
CPP1		
Computer Science		
1. Computer Science	5	0
Sub Total	5	0
Total	105	19

Technical Review Form

Panel #2 - EIR Mid-Phase - 2: 84.411B

Reader #3: *****

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Questions

Selection Criteria - Significance

1. The Secretary considers the significance of the proposed project. In determining the significance of the proposed project, the Secretary considers the following factors:

Reader's Score: 0

Sub

1. (1) The national significance of the proposed project.

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

2. (2) The potential contribution of the proposed project to increased knowledge or understanding of educational problems, issues, or effective strategies.

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

Strategy to Scale - Strategy to Scale

1. The Secretary considers the applicant's strategy to scale the proposed project. In determining the applicant's capacity to scale the proposed project, the Secretary considers the following factors:

Reader's Score: 0

Sub

- 1. (1) The extent to which the applicant identifies a specific strategy or strategies that address a particular barrier or barriers that prevented the applicant, in the past, from reaching the level of scale that is proposed in the application.**

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

- 2. (2) The mechanisms that applicant will use to broadly disseminate information on its project so as to support further development or replication.**

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

Selection Criteria - Quality of Project Design

- 1. The Secretary considers the quality of the design of the proposed project. In determining the quality of the design of the proposed project, the Secretary considers the following factors:**

Reader's Score: 0

Sub

- 1. (1) The extent to which there is a conceptual framework underlying the proposed research or demonstration activities and the quality of that framework.**

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

- 2. (2) The extent to which the goals, objectives, and outcomes to be achieved by the proposed project are clearly specified and measurable.**

Sub

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

3. (3) The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs.

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

Selection Criteria - Adequacy of Resources

1. The Secretary considers the adequacy of resources and the quality of the management plan for the proposed project. In determining the adequacy of resources and quality of the management plan for the proposed project, the Secretary considers the following factors:

Reader's Score: 0

Sub

1. (1) The applicant's capacity (e.g., in terms of qualified personnel, financial resources, or management capacity) to bring the proposed project to scale on a national or regional level (as defined in 34 CFR 77.1(c)) working directly, or through partners, during the grant period.

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

2. (2) The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.

Strengths:

N/A

Sub

Weaknesses:

N/A

Reader's Score:

3. (3) The extent to which the costs are reasonable in relation to the objectives, design, and potential significance of the proposed project.

Strengths:

N/A

Weaknesses:

N/A

Reader's Score:

Selection Criteria - Quality of the Project Evaluation

1. The Secretary considers the quality of the evaluation to be conducted of the proposed project. In determining the quality of the evaluation, the Secretary considers the following factors:

Reader's Score: 19

Sub

1. (1) The extent to which the methods of evaluation will, if well implemented, produce evidence about the project's effectiveness that would meet the What Works Clearinghouse standards without reservations as described in the What Works Clearinghouse Handbook (as defined in 34 CFR 77.1(c)).

Strengths:

The applicant clearly indicated that a blocked cluster randomized controlled trial would be implemented for the proposed project to determine the effectiveness of the MHS program (p. e36). Two cohorts over two school years would be part of the proposed project which would be randomly assigned to intervention and business-as-usual powered to detect an expected effect size of .20 based on a previous study and an overall effect size of .14 (p. e38). The applicant also clearly provided selection criteria to be part of the proposed project (pp. e37-e38). For example, recruited teachers would include high need schools, free or reduced lunch, below scores on state tests, and computer capability to implement the MHS program. Moreover, the proposal explained the strategies to exclude joiners and minimize attrition (p. e39). For example, to minimize the issue of joiners, consent forms would be obtained before random assignment and to minimize attrition, teachers would collect pre/post-test data to ensure complete data from participants. Finally, the applicant would collect baseline data to assess baseline equivalence and the inclusion of covariates in the data analysis, if needed (p. e40). The applicant provided comprehensive information to determine the methods of evaluation to meet the WWC standards without reservations.

Weaknesses:

Although the applicant stated that support systems for teachers (full support vs lower-cost support) through interviews would determine the adequacy of lower-cost support and possible barriers of implementation (p. e44), the applicant did not clearly describe the cost effectiveness methods of the proposed project to answer the question, what is the cost-effectiveness of each of the versions of MHS? (p. e36). It was not detailed the cost information to be included to calculate the cost effectiveness, and it was not explained how the cost effectiveness

Sub

would be measured (e.g., ratio).

Reader's Score:**2. (2) The extent to which the evaluation will provide guidance about effective strategies suitable for replication or testing in other settings.****Strengths:**

The applicant clearly provided ten evaluation questions including the assessment of the impact, scale-up, and implementation of the proposed project (p.e36-e37). The applicant also indicated the 23 multiple-choice question Water Systems Assessment (WSA) ($\alpha = 0.72$) would be utilized to measure content knowledge aligned to the learning standards NGGS and a 12-question multiple-choice Argumentation Assessment (AA) ($\alpha = 0.60$) to measure the identification of critical components and argumentation (pp. e40-e41). The pretest would include demographic information and self-rating about participant's science class performance (p. e41). The applicant indicated that students' engagement would be measured as an intermediate outcome utilizing the Panorama Student Survey ($\alpha > .70$) (p. e41).

Weaknesses:

The applicant provided limited information about the development of effective strategies for replication or testing in other settings. Moreover, it was unclear if subgroup analyses would be performed to determine variations among groups to initiate action plans to adjust the implementation process. Thus, the applicant did not clearly explain the process to develop effective strategies to support teachers to be suitable for replication in other settings.

Reader's Score:**3. (3) The extent to which the evaluation plan clearly articulates the key project components, mediators, and outcomes, as well as a measurable threshold for acceptable implementation.****Strengths:**

The applicant clearly stated the key components, mediators, and outcomes of the proposed project (p. e87) as well as development of the threshold of implementation (p. e46). For example, under inputs improved game play, teacher support system, expand platform, and capacity for scale-up were indicated; teacher and student outcomes were provided; and short-term, intermediate, and long-term outcomes were presented. Short-term outcomes were indicated as the mediators of the proposed program including teacher implementation of MHS (participation in community of teachers and creation of classroom community of students) and student progress through units. The applicant clearly indicted the original fidelity matrix, to be updated, assessing the proposed program component, definition, criteria, measure, item metric, threshold of implementation, sample to be measured, and years of measurement (pp. e158-e162) with a threshold of high level of implementation of 80% (p. e158). As the fidelity matrix is updated, the thresholds for acceptable implementation would be established for the full MHS analytical sample across the units implemented (p. e46).

Weaknesses:

The applicant provided limited information about how the mediators (p. e87)) would be used to determine their impact on project outcomes. The applicant did not clearly indicate if teacher variables such as teaching experience and level of technology use could influence the results and could be included as mediators. The applicant did not clearly indicate the protocols to update the fidelity matrix to ensure validity and reliability of the measures of the updated instrument.

Reader's Score:

Priority Questions

CPP1 - Computer Science

1. **Projects designed to improve student achievement or other educational outcomes in computer science (as defined in this notice). These projects must address the following priority area: Expanding access to and participation in rigorous computer science coursework for traditionally underrepresented students such as racial or ethnic minorities, women, students in communities served by rural local educational agencies (as defined in this notice), children or students with disabilities (as defined in this notice), or low-income individuals (as defined under section 312(g) of the Higher Education Act of 1965, as amended).**

Strengths:

N/A

Weaknesses:

N/A

Reader's Score: 0

Status: Submitted

Last Updated: 08/05/2021 09:45 PM

Status: Submitted

Last Updated: 08/13/2021 02:59 PM

Technical Review Coversheet

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Reader #4: *****

	Points Possible	Points Scored
Questions		
Selection Criteria		
Significance		
1. Significance	15	13
Sub Total	15	13
Strategy to Scale		
Strategy to Scale		
1. Strategy to Scale	20	19
Sub Total	20	19
Selection Criteria		
Quality of Project Design		
1. Project Design	20	17
Adequacy of Resources		
1. Quality of the Management	20	19
Quality of the Project Evaluation		
1. Project Evaluation	25	
Sub Total	65	36
Priority Questions		
CPP1		
Computer Science		
1. Computer Science	5	0
Sub Total	5	0
Total	105	68

Technical Review Form

Panel #2 - EIR Mid-Phase - 2: 84.411B

Reader #4: *****

Applicant: The Curators of the University of Missouri Special Trust (S411B210031)

Questions

Selection Criteria - Significance

1. The Secretary considers the significance of the proposed project. In determining the significance of the proposed project, the Secretary considers the following factors:

Reader's Score: 13

Sub

1. (1) The national significance of the proposed project.

Strengths:

74% of parents believe games can be educational for students but most games in schools are short-form and only used to introduce a topic (page e17). From a students' perspective active, engaging, experience of playing games is often significantly different than passive, placid nature of being in a classroom (page e17). Effective use of technology is an important national goal (page e18).

Weaknesses:

The applicant did not address if science education achievement is of national significance – are students doing well in science nationally or do our students need help? Statistics from NAEP could have strengthened applicant's case.

Reader's Score:

2. (2) The potential contribution of the proposed project to increased knowledge or understanding of educational problems, issues, or effective strategies.

Strengths:

MHS research will help build on “short form games used to simply introduce a topic” (page e17) like how to engage students, especially those uninterested in science. Moreover, this research will contribute towards the “new normal” of teaching after covid (page e17). Embedded assessment in gaming is an alternative testing approach that would be researched by the applicant (e27). These innovations will increase knowledge about game design, science content engagement via games, and assessments built into games, and represent significant contributions to education problems.

Weaknesses:

Applicant does not address how specifically this proposal will increase student achievement and how previous evidence points to that. It is also unclear why the applicant is focusing on water systems.

Reader's Score:

Strategy to Scale - Strategy to Scale

1. The Secretary considers the applicant's strategy to scale the proposed project. In determining the applicant's capacity to scale the proposed project, the Secretary considers the following factors:

Reader's Score: 19

Sub

1. (1) The extent to which the applicant identifies a specific strategy or strategies that address a particular barrier or barriers that prevented the applicant, in the past, from reaching the level of scale that is proposed in the application.

Strengths:

Applicant focuses on key strategies that address barriers faced in the previous study: now the curriculum is alignment to NGSS standards (p. e25), has continuous improvement classrooms to expedite improvement (p. e26), includes embedded assessments within the app (p. e26), builds an evidence-based teacher support system (p. e27) developed by eMINTS National center. The applicant also focuses on modern app development (p. e29) instead of traditional computer lab desktop computers (focus of the previous study). Lastly, the myMHS system will be designed to make it easier for teachers (p. e30) to implement the program. Applicant is fully addressing barriers specifically identified from the previous study, and this will help scale up the program.

Weaknesses:

No weaknesses identified.

Reader's Score:

2. (2) The mechanisms that applicant will use to broadly disseminate information on its project so as to support further development or replication.

Strengths:

Applicant has clearly identified audience for dissemination (p. e30) including science teachers, administrators, researchers, game developers. Applicant's use of websites, YouTube programming, academic journals, conferences, and open-source assets will allow for successfully disseminating information to all the relevant audiences.

Weaknesses:

Applicant does not discuss dissemination activities from previous study and/or if they were successful or what lessons were learned from them.

Reader's Score:

Selection Criteria - Quality of Project Design

1. The Secretary considers the quality of the design of the proposed project. In determining the quality of the design of the proposed project, the Secretary considers the following factors:

Sub

1. (1) The extent to which there is a conceptual framework underlying the proposed research or demonstration activities and the quality of that framework.

Strengths:

The teacher professional development framework is designed by eMINTS (p. e27) which provides evidence-based teacher professional development. The PD model will be constructivist (p. e28) and is supported with 20 years of external research. The new curriculum on water systems is research based with alignment to NGSS standards (p. e22) so students will be learning content based on high standards. Applicant is re-using the water system assessment from the previous study as it has already been validated (p. e40) which will lead to accurate measures of student/proposal success.

Weaknesses:

No weaknesses identified.

Reader's Score:

2. (2) The extent to which the goals, objectives, and outcomes to be achieved by the proposed project are clearly specified and measurable.

Strengths:

Two goals on page e18 have defined objectives. are connected to outcomes and are measurable. The goals/objectives are aligned to the management plan on page e174 and are specific enough to serve as excellent proxies for successfully implementing the program.

Weaknesses:

No weaknesses identified.

Reader's Score:

3. (3) The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs.

Strengths:

Positive feedback from teachers in the pilot study suggests that students were very engaged, and the new curriculum will be targeted to NGSS standards (p. e21). Research suggests that games are an important approach for achieving NGSS aligned learning (p. e21). The new water systems module is research based and teachers will be able to see student progress (p. e22) and as a result student needs will likely be met. Applicant also states that the previous study had an effect size of .2 and the new study should be similar in effectiveness (pp. e38-39).

Weaknesses:

The application overall lacks a focus on a specific target segment of students and the text on page e20 suggests the focus is primarily disengaged students who don't have an innate interest in science. This focus could have been emphasized more throughout the application.

Reader's Score:

Selection Criteria - Adequacy of Resources

1. The Secretary considers the adequacy of resources and the quality of the management plan for the proposed project. In determining the adequacy of resources and quality of the

management plan for the proposed project, the Secretary considers the following factors:

Reader's Score: 19

Sub

1. (1) **The applicant's capacity (e.g., in terms of qualified personnel, financial resources, or management capacity) to bring the proposed project to scale on a national or regional level (as defined in 34 CFR 77.1(c)) working directly, or through partners, during the grant period.**

Strengths:

Partnerships on page e32 show collaboration between Adroit Game Lab which will handle game development, eMINTS which will handle teacher development, MOREnet which will handle myMHS, and Abt which will handle evaluation. These partnerships show how the applicant has identified specific areas for development and found the relevant partner to focus on each area, giving a boost to the capacity of the applicant to bring the proposed project to scale.

Weaknesses:

No weaknesses identified.

Reader's Score:

2. (2) **The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.**

Strengths:

Management plan (page e35) matches the performance indicators on page e175). The performance indicators help breakdown the management plan into specific objectives with clearly defined entities (partner organizations) responsible for each objective. The plan shows how all objectives will be met within the five-year study duration.

Weaknesses:

No weaknesses identified.

Reader's Score:

3. (3) **The extent to which the costs are reasonable in relation to the objectives, design, and potential significance of the proposed project.**

Strengths:

Game development is costly, but the applicant states MHS may lack graphics and animation of other games in order to be cost effective (page e33). Cost of the app (per student) will go down as more schools sign up (p. e35). Looking at the cost breakdown for personnel, programmers are the largest segment (p. e165) and that seems reasonable due to the cost of developing a game-based app. Applicant has also identified the cost for continuing to offer the program to schools after the grant expires (p. e35) to be as low as \$3 per student.

Weaknesses:

Applicant does not link to previous study cost models and how that influenced the cost model in this proposal.

Sub

Reader's Score:

Selection Criteria - Quality of the Project Evaluation

1. The Secretary considers the quality of the evaluation to be conducted of the proposed project. In determining the quality of the evaluation, the Secretary considers the following factors:

Reader's Score:

Sub

1. (1) The extent to which the methods of evaluation will, if well implemented, produce evidence about the project's effectiveness that would meet the What Works Clearinghouse standards without reservations as described in the What Works Clearinghouse Handbook (as defined in 34 CFR 77.1(c)).

Strengths:

Weaknesses:

Reader's Score:

2. (2) The extent to which the evaluation will provide guidance about effective strategies suitable for replication or testing in other settings.

Strengths:

Weaknesses:

Reader's Score:

3. (3) The extent to which the evaluation plan clearly articulates the key project components, mediators, and outcomes, as well as a measurable threshold for acceptable implementation.

Strengths:

Weaknesses:

Reader's Score:

Priority Questions

CPP1 - Computer Science

1. **Projects designed to improve student achievement or other educational outcomes in computer science (as defined in this notice). These projects must address the following priority area: Expanding access to and participation in rigorous computer science coursework for traditionally underrepresented students such as racial or ethnic minorities, women, students in communities served by rural local educational agencies (as defined in this notice), children or students with disabilities (as defined in this notice), or low-income individuals (as defined under section 312(g) of the Higher Education Act of 1965, as amended).**

Strengths:

N/A, this proposal does not include a computer science competitive preference design component.

Weaknesses:

N/A, this proposal does not include a computer science competitive preference design component.

Reader's Score: 0

Status: Submitted

Last Updated: 08/13/2021 02:59 PM