

CSC324 GCIEL Team

GCIEL Assessment Strategy Update: Project Documentation

Spring CSC324-02: Software Design and Development

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5-8-2024

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Project Overview

Purpose:

The GCIEL Viking Longship Project aims to pave the way for teaching within the 21st century by incorporating VR into the academic learning experience. The GCIEL Assessment Strategy project is a continuation with a focus to create a better learning experience for students. The app was developed to easily display how students performed within the Viking longship experience to find areas of interest and confusion among students.

Users:

The intended users of the project include students, educators, researchers, and next developers. The Viking Longship Project targets students and educators learning about the Viking longship building process and the information for each ship building piece. The project's future visions are meant to give a path for the next developers of the Viking Longship project as it will be passed to Cornell College next. Researchers looking for player information to see human interaction with VR experiences can also use this app to find helpful correlations to improve VR learning retention.

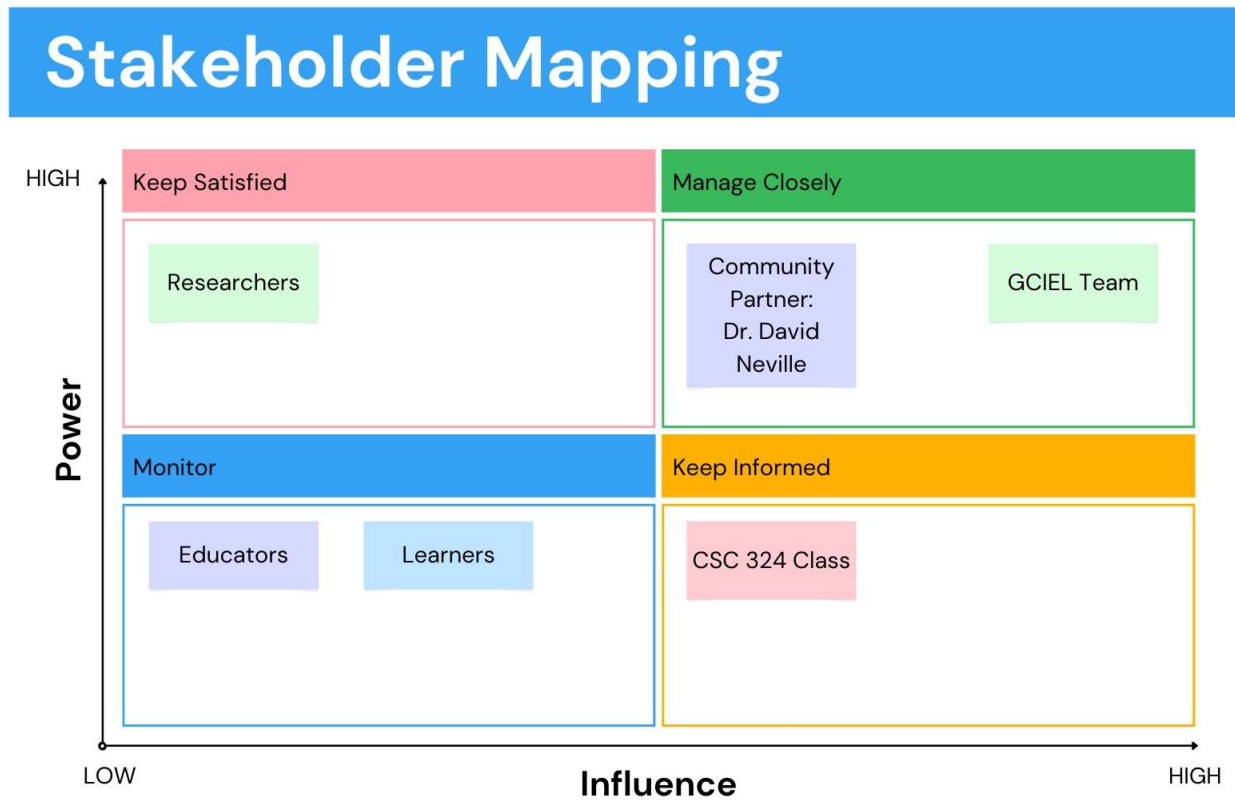
Technology Use:

The Viking Longship project is a VR experience run through Unity. The data taken from this was the X, Y, and Z head position of the player, which piece is currently being viewed, and what piece is currently displayed. An R Shiny app was made to create useful visualizations with the data extracted.

End Product:

The end product includes two versions of the GCIEL Assessment Strategy app as well as documentation on the future vision of the Viking Longship experience and beyond. The two versions include an app interpreting ideal mock data of multiple runs and another app interpreting real data taken from student playthroughs. The goals of these apps are to find areas within the simulation that might not be inclusive to different learning.

Stakeholder Map



Stakeholder map created with Canva [1].

Functionality

What Works:

Data collection methodologies work. Working with Oscar has allowed us to implement data collection methods to improve data that can allow VR developers to accurately analyze ways to improve VR learning.

We have continued the development of the R Shiny application which displays data visualizations. The Data Visualization tab is temporarily disabled until the user has input data. We have also included a 10-observation display right below the data upload section to allow the primary user to ensure the correct data is uploaded; furthermore, we have categorized the visualizations into two sections to better reflect the types of visualizations that we have. Because we have a visualization that takes a while to load, we have implemented a loading screen to ensure the user understands that the visualization is loading and not to leave the tab.

Additionally, we have continued the use of the old questionnaire based on the ARCS model. Should the questionnaire need to be updated, we can do so by providing the link for a new questionnaire via Google Form or other means.

What Needs Improvement:

Implementing more data visualizations will allow us to analyze data in multiple views. While we have several data visualizations within our Shiny App, these data visualizations may not accurately reflect whether VR improves or inhibits learning opportunities. As such, constant updating of data visualizations to accurately analyze VR user data will help VR developers to improve their product, thereby enhancing learning.

Additionally, improving data collection strategies would improve how we can analyze VR learning. A prime example of this would be collecting data regarding where the user is looking – this is currently defined as the center point on the VR headset. The primary issue is that certain objects are relatively small, resulting in the dataset showing that the user is looking at a wall or ceiling despite having a Viking ship piece in view. Increasing the specificity of where the user is looking – i.e. being able to log the primary item or object within view – will allow us to better analyze where people are looking within VR, be it the information tab or the Viking artifact.

Insights

The project gives us a set of comprehensive and useful visualizations for the VR system used for education and testing purposes. The project displayed both static and dynamic visualizations for the data that given by David and Oscar, revealing patterns for users who have already tested the project.

Firstly, the project utilized the bar graph and dot graph to give users an understanding of the testers' involvement in the game. The first graph shown that testers used an average of 220 seconds to complete each piece that constitutes the boat (The "boat" is the tutorial part for the game, in which users use VR devices to build the Viking boat with the wooden pieces). This revealed the fact that the tutorial is designed in a reasonable shape where users do not need to spend much on a single piece of the boat. On the other hand, the video engagement analysis shows a big gap between the percentage of video watched for different pieces, ranging from more than twenty percent to sixty percent. This fact revealed that testers have different preference over the information provided by the game. The fact that some parts are indicated to be more interested than other parts can be used to further improve the composition of the videos provided in the game. Finally, the 2D distance analysis by player and piece revealed a chaotic system where testers are moving in. The patterns shows that all testers were moving in a cyclic form around the foundation of the boat and scattered averagely in the four corners of the map. Such information, in the future, can be useful for providing a guidance for developers since they may find out the points and places where users are less likely to visit and identify potential bugs in the game.

Secondly, the heatmap series provided information from another aspect. As we know, the heatmap visuals the frequency which testers visit each place on the map. Therefore, for the heatmap, we can obtain a direct understanding of the motion from testers on the X-Z axis. We noticed that the "next piece location" shows a very high frequency for visiting. Therefore, we can infer that users follow the pattern for 1. Take the piece. 2. Move to the boat. 3. Build the boat. 4. Come back to take the piece. Additionally, the rectangle area under the boat, although is accessible, is less likely to be visited compared with other places. This revealed that the game helped users to locate the price on the boat in a good way such that there is no need for them to come into the boat and check where is the piece should be located. On the other hand, the player location animation provides a valuable GIF which is used to keep track of the motion by single user. Therefore, we noticed that many testers followed a similar pattern for building the boat and moving in the map. This is helpful for future development and extension of the game.

Future Improvements

Looking forward to the end of this project as well as the end of the GCIEL development grant, we would like to present the following considerations regarding the future of this project development and design:

First, we recommend creating optional/selectable color palettes, image captions, subtitles, audio descriptions, audio commands, and differing contrast capability to accurately transfer information to all interested parties.

Second, we recommend working closely with the Experience Development team and Experience Assessment team to create live player specific data for each user. This can be quickly and efficiently analyzed through the app by an administrator to understand individual engagement.

Third, we recommend adding constant controller reminders for users. Specifically in the tutorial, proper instructions detailing how the user can navigate the game would make the learning experience more efficient. Additionally, adding button reminders during the experience would benefit learning efficiency.

Fourth and adding onto part three, we recommend having user reminder and instructions available during the ship building scene and so forth. Given that the application of the experience can be used by a variety of age ranges, maximizing the learning experience while minimizing the learning curve of VR is imperative.

Fifth, we recommend implementing a VR selection panel. This panel would allow the user to choose their specific VR console. Since this experience is designed for use compatibility across a multitude of VR devices, discerning which one the user is using will allow for a simpler description of in-game control instructions.

Sixth and final, we recommend brainstorming ways in which the Viking experience can be expanded. Additionally, brainstorming ways in which this design could be adapted to other learning experiences such as the Pyramids of Egypt, the Globe Theater experience, or engine development would allow for simple hands on learning experiences for a multitude of disciplines.

References

[1] Canva, “Canva,” *Canva*. <https://www.canva.com/>

Appendix

MEMORANDUM OF UNDERSTANDING & CONFIDENTIALITY AGREEMENT

COMMUNITY-ENGAGED LEARNING

This Agreement is entered into between (1) Grinnell College, hereinafter known as the “Institution,” (2) the community partner organization identified in this application, hereinafter known as the “Community Partner,” (3) Grinnell College Students, hereinafter known as the “Students,” (4) Grinnell College Faculty Supervisors, herein known as the “Faculty Supervisor,” in the purpose of providing *curricular community-engagement opportunities* with Grinnell College Students.

PART I: MEMORANDUM OF UNDERSTANDING

Recitals:

1. Community-Engaged Learning initiatives are carried out in conjunction with the Community Partner.
2. The Institution provides support and funding; the students provide services; and the Community Partner provide a mentored opportunity for professional development.

NOW, THEREFORE, in consideration of the mutual covenants contained herein, the Parties hereto agree as follows:

Responsibilities:

The Parties’ responsibilities with regard to Community-Engaged Learning and assigned Students are as set forth below:

A. THE COMMUNITY PARTNER:

The Community Partner Organization AGREES TO:

- a. Utilize the services of student(s) of the Institution who are eligible to engage with the community, who are qualified for curricular community-engagement opportunities, and who are acceptable both to the Community Partner and Institution;
- b. Any changes must be reported to the Faculty Supervisor and must be agreed upon by the Institution before they become effective;

- c. Comply with all appropriate federal, state and local laws;
- d. Determine requirement of Student background check(s) before commencing service and await clearance administered by either the Institution or the Community Partner.
- e. The Community Partner agrees that no Student will be denied opportunity to engage with Partner or be subjected to different treatment on the grounds of race, color, creed, religion, national origin, sex, sexual orientation, age, marital status, disability, or status as a disabled veteran or Vietnam era veteran. It further agrees that it will comply with the provisions of the Civil Rights Act of 1964 (Pub. L. 88-352; 78 Stat. 252) and Title IX of the Educational Amendments of 1972 Pub. L. 92-318) and the regulations of the US Department of Education which implement these acts;
- f. Regulate the amount of service contributed in accordance with the hours delegated to the Student by the Faculty Supervisor and Institution; Notify the Faculty Supervisor of any change affecting the student's role;
- g. Permit representatives of the Institution to perform on-site visits when needed;
- h. Comply with the Grinnell College Policy, Procedures, and Guide to Preventing, Reporting, and Responding to Sexual Misconduct and Other Forms of Interpersonal Violence. This policy applies to all forms of sexual and gender-based harassment, sexual assault, sexual exploitation, intimate partner violence (including dating violence and domestic violence), stalking, and retaliation;
- i. Comply with Family Educational Rights & Access ([FERPA](#)); the Community Partner must have written permission from the parent or eligible Student in order to release any information from the Student's educational record;
- j. Provide Student (s) with an explanation of responsibilities, performance requirements in terms of quality, quantity, methods, and priorities of their service.
- k. Complete institution's survey designed to assess the student's service and their impact on the community partner's work;
- l. Any and all intellectual property, materials and other service product (including any patents, copyrights, or other intellectual property rights therein) created by Grinnell College Students under this Memorandum will be owned by the Students. The Community Partner must have written consent from the Student(s) before sharing or promoting such property;
- m. Any intellectual property, materials or other work product jointly created by Students and one or more employees of Community Partner Organization (such that they would be joint inventors or joint copyright holders under relevant intellectual property law) will be jointly owned by the Students and Community Partner, with each party able to use the jointly-created work without accounting to the other and without the consent of the other.

B.THE INSTITUTION

(Grinnell College) AGREES TO:

- a. Determine student eligibility for community-engaged coursework;

- b. Determine requirement of Student background check(s) before commencing service and await clearance administered by either the Institution or the Community Partner; cover fees of background check;
- c. Only refer students for placement who are eligible (i.e. International student who completed CPT);
- d. Comply with Family Educational Rights & Access ([FERPA](#)); the Institution must have written permission from the parent of / or eligible Student in order to release any information from the Student's educational record;
- e. Any and all intellectual property, materials and other work product (including any patents, copyrights, or other intellectual property rights therein) created by Grinnell College Students under this Memorandum (collectively, "Student Service") will be owned by the Students; The Institution must have written consent from the Student(s) before sharing or promoting such property;
- f. Any pre-existing materials provided by the Community Partner for use in a project will remain the property of the Partner, though both the Institution and its Students are hereby granted a license to use such materials for the project.

C. THE STUDENTS

(Grinnell College Students) AGREE TO:

- a. Follow instructions for background check(s) before commencing service and await clearance administered by either the Institution or the Community Partner.
- b. Respect commitments made with Community Partner and make significant effort to meet appointments, deadlines, and related expectations of project-based service; acknowledge community engaged service is mutually beneficial and reciprocal.
- c. Communicate any needs, obstacles, and/or challenges during partnership to address or determine adjustments necessary regarding service;
- d. Not exceed the requirements outlined with the Community Partner & Faculty supervisor without consultation with related faculty and/or staff connected to their project-based work;
- e. Participate in (guided) reflection of the community-engaged experience throughout and at end the course/project; evaluate what one has learned and identify further civic and professional development goals;
- f. If Students encounter bias, harassment, or other forms of implicit or explicit mistreatment during their experience, they will file a report and seek legal assistance from the Institution ([Bias Incident Report](#) and [Title IX Information](#));
- g. Students will not share confidential data or personal information (See Part II: Confidentiality Agreement) related to their community-engaged service outside of individuals directly related to the project/course; start
- h. Students will not use unauthorized third party intellectual property for their service projects; this includes property that is not open-sourced or does not hold creative commons license;

- i. Students grant to the Community Partner a worldwide, non-exclusive, perpetual, royalty-free right and license to copy, modify, publish, distribute and otherwise use any and all Student work submitted under this Memorandum for purposes consistent with the Community Partner Organization's status as a [government ministry, non-governmental or non-profit organization];
- j. Each Student grants to the Institution a perpetual, non-exclusive, worldwide, royalty-free license to publicly perform, publicly display, modify, create derivatives of and otherwise use for academic, educational, administrative or research purposes any and all Student service;
- k. Any pre-existing materials provided by the Community Partner for use in a project will remain the property of the Partner, though both the Institution and its Students are hereby granted a license to use such materials for the project;
- l. Any intellectual property, materials or other service product jointly created by Students and one or more employees of Community Partner Organization (such that they would be joint inventors or joint copyright holders under relevant intellectual property law) will be jointly owned by the Students and Community Partner, with each party able to use the jointly-created service without accounting to the other and without the consent of the other.

D. THE FACULTY SUPERVISOR

AGREES TO:

- a. Determine requirements for background check(s) before commencing service and await clearance administered by either the Institution or the Community Partner;
- b. Respect commitments made with Community Partner; approach community engaged learning relationships as mutually beneficial and reciprocal;
- c. Maintain and communicate general learning objectives relevant to any Student placements;
- d. Report any mid-term or academic year changes to the agreement or course to the Community Partner;
- e. Offer Students the opportunity to assess and reflect upon their community-engaged learning;
- f. Provide Community Partner with surveys designed to assess the student's service, assess the student's impact on the community partner's mission, and offer the Community Partner an opportunity to continue or discontinue participation with a community-engaged class.
- g. Comply with Family Educational Rights & Access ([FERPA](#)); the Faculty Supervisor must have written permission from the parent or eligible Student in order to release any information from the Student's educational record;
- h. Any and all intellectual property, materials and other work product (including any patents, copyrights, or other intellectual property rights therein) created by Grinnell College Students under this Memorandum (collectively, "Student Service") will be owned by the Students; The Faculty Supervisor must have written consent from the Student(s) before sharing or promoting such property;

[ADD OTHER SECTIONS HERE]

Start date:

The Project began on March 28th, 2024, with the initial project kick-off meeting with the Grinnell College Immersive Experiences Laboratory (GCIEL). The meeting was conducted between the student group and Dr. David Neville.

Description/ Scope of the project and community partner:

The purpose of the GCIEL Viking Longship Assessment Strategy project is to implement an effective assessment strategy for evaluating learning outcomes within a Viking Longship Virtual Reality (VR) game. The focus is to expand on the ARCS model (Attention, Relevance, Confidence, and Satisfaction) designed by the first student group in the fall of 2023. Their goal was to measure motivation and intention in the VR setting.

The goal of this project is to work in tandem with the GCIEL team and enhance the learning experience for users engaging in the VR Viking Longship building game. By taking advantage of the previous work, the data display can be expanded into a presentable visualization acting as a medium to help educators, future developers, and grant oversight committees understand the user interaction within the VR design.

By combining these two designs, an accurate display will be created detailing user interaction. The project is thus relevant to anyone interested in Viking Cultures as this game will be deployed in museums in the future. Game developers and educators alike can use the collected data for continuous improvements in use as well as future advancements.

The Deliverables:

- We will provide an app visualizing the prospective data provided by the GCIEL as well as documentation regarding the final product. This involves taking the original mock-data and expanding upon already existing visualizations to make a publishable product.
- We will additionally contribute to the GCIEL conclusion process by acting as “game-testers” helping the development team understand how novice users will interact with the learning platform. The goal is to help with a smooth transition through the end of grant transfer and testing phases.
- We will help to edit and revise the current user survey to gain more applicable feedback from users outside the tester and development team.

- We will meet weekly on Tuesdays with Dr. David Neville and available others on the GCIEL team to present updates as well as gain feedback.

Costs & funding

No financial support is required of either party.

Warranty

Nothing in this Memorandum shall be construed as consent by either party to enter into a contract, subcontract or other business relationship. Activities (if any) in which the parties wish to engage pursuant to this Memorandum will not be binding unless agreed to in a separate written document executed by an authorized representative of each party. Neither the Institution, nor the Students make any warranty, express or implied, concerning the work to be performed under this Memorandum. Grinnell College specifically disclaims any and all implied warranties, including without limitation the warranties of fitness for a particular purpose and merchantability. Neither party will be liable for any incidental, consequential or special damages under this Memorandum.

Release of Liability of Institution

The Community Partner waives, releases, holds harmless and forever discharges the Institution and its employees, agents, officers, trustees and representatives (in their official and individual capacities) from any and all liability whatsoever for any and all damages, losses, injuries, and expenses (including attorney fees) arising in whole or in part out of a student's actions or inactions.

Termination

This agreement may be terminated at any time by the institution or by mutual consent; if not terminated, this agreement will remain in effect until superseded by another agreement, or until changes in legislation or regulations render this agreement invalid. The college may, at any time and in its sole discretion, discontinue the program and withdraw its support from the agency for any reason and shall not be liable for any loss (including financial loss) to the agency by reason of such discontinuation or withdrawal.

This MOU shall remain in effect until 05/14/2024

Student not Agent of College

Under no circumstances shall a Fellow be treated as an agent or employee of the College.

Miscellaneous

The rights and obligations of the Parties to this MOU may not be assigned or subcontracted unless such assignment or subcontract is in writing and consented to by the Parties hereto. This MOU shall be binding upon and shall inure to the benefit of the Parties hereto and their respective legal representatives, heirs, successors and permitted assigns. Nothing in this MOU, express or implied, is intended to confer upon any party (including, without limitation, Fellows), other than the Parties hereto (and their respective heirs, legal representatives, successors and permitted assigns), any rights, remedies, obligations or liabilities under or by reason of this MOU. This MOU constitutes the entire agreement between the Parties hereto pertaining to the subject matter hereof and supersedes all negotiations, preliminary agreements and all prior and contemporaneous discussions and understandings of the Parties in connection with the subject matter hereof. No amendment, change or modification of any of the terms, provisions or conditions of this MOU shall be effective unless made in writing and signed or initialed by all Parties. Waiver of any provision of this MOU shall not be deemed a waiver of future compliance therewith and such provision shall remain in full force and effect. In the event any provision of this MOU is held invalid, illegal or unenforceable, in whole or in part, the remaining provisions of this MOU shall not be affected thereby and shall continue to be valid and enforceable. This MOU shall be governed by and construed in accordance with the laws of the State of Iowa, United States of America, without regard to conflicts of laws principles.

In addition to any other remedies available at law or in equity to the Parties hereto with respect to a breach hereof, the Parties hereto each reserve the right to enforce this MOU by

specific performance. The titles or captions of paragraphs in this MOU are provided for convenience of reference only, and shall not be considered a part hereof for purposes of interpreting or applying this MOU and such titles or captions do not define, limit, extend, explain or describe the scope or extent of this MOU or any of the terms or conditions. Words and phrases herein shall be construed as in the singular or plural number, and as masculine, feminine or neuter gender, according to the context. This MOU shall not be construed more strongly against any Party regardless of who was more responsible for its preparation. **THE PARTIES HEREBY IRREVOCABLY WAIVE ALL RIGHT TO TRIAL BY JURY IN ANY ACTION, PROCEEDING OR COUNTERCLAIM ARISING OUT OF OR RELATING TO THIS MOU.**

PART II: CONFIDENTIALITY AGREEMENT

Student Confidentiality Agreement

Students of Grinnell College ("Institution") may have access to confidential student, employee, and community partner information about financial, educational, personnel, medical, academic and other matters from various media (paper and electronic) and sources including, but not limited to, interoffice communications, internal publications, verbal interactions, correspondence, and data bases. By virtue of the student's role with a community-engaged course, they are accountable for the responsible use and disclosure of the institution's and community partner's information and for ensuring the confidentiality, integrity, and accuracy of such information.

- a. Students agree to the responsibility and accountability for maintaining the confidentiality of all student, employee, alumni and College related information, and community partner information. This information will only be disclosed, distributed, or discussed as part of the normal performance of my role in a community-engaged course, and only with individuals authorized to view and discuss such information.
- b. Students will not attempt to alter, change, modify, add, or delete student, employee, community partner or other College information or documents, except as part of the normal performance of their role. Students will follow proper College procedures for the disposal of confidential information.
- c. Students will access only information required for the normal performance of their role. Access to information, which includes written documents, electronic files, student educational or financial records, and personnel data, records or files, will occur only through normal business procedures for obtaining information.
- d. All procedures, written documents, records, and computer programming that Students generate, access, input, modify, report, record, etc. shall be done in accordance with College policies, regulations established by applicable governing bodies, or applicable laws. Confidential information is considered property of the Institution & Community Partner and will not be disclosed to third parties without permission of the College.

- e. Students will take all reasonable precautions to protect the confidentiality of information by the practice of good work habits. These include: protecting the confidentiality of passwords, closing or minimizing programs when not at the terminal, and promptly informing appropriate parties of any breach of confidentiality or security on my part (e.g., the loss of a document, the loss of a key).

Student Signature below additionally agrees to the following:

Failure to abide fully with this Confidentiality Agreement is grounds for disciplinary action following the regulations specified within the appropriate Handbook (staff, faculty, or student). Disclosing confidential information without proper authorization may violate the Family Educational Rights and Privacy Act of 1974 ([“FERPA”](#)) and other federal and State laws and regulations that protect the confidentiality of information, and may subject the College and/or the student to civil and/or criminal liability.

Signature below indicates that the student has read and understands the above and agrees to the terms of this Confidentiality Agreement. Without limiting the foregoing, a signature below agrees not to disclose Institution, Community Partner, or Student confidential information to any unauthorized person or organization while fulfilling civic components of a community engaged course. This Confidentiality Agreement shall be governed and construed in accordance with the laws of the State of Iowa.

Part III: Signatures

"Institution"

GRINNELL COLLEGE

By: _____

Printed Name: _____

Title: _____

Address: _____

Email for Notices: _____

Date: _____

"Community Partner"

GCIEL

By: 

Printed Name: David Neville

Title: Dr

Address: CTLA, Grinnell College, Grinnell, Iowa, 50112

Email for Notices: nevilled@grinnell.edu

Date: 03/28/24

"Students"

STUDENTS OF GRINNELL COLLEGE

By: Ian Wagner Brown, Kelton Watts, Haobo Chen, Joshua Sutton, Ethan Yuen

Printed Name: Ian Wagner Brown, Kelton Watts, Haobo Chen, Joshua Sutton, Ethan Yuen

Grinnell Email: brownian@grinnell.edu, wattskel@grinnell.edu, chenhaob@grinnell.edu, suttonjo@grinnell.edu, yuenetha@grinnell.edu

Date: 3/27/2024

"Faculty Supervisor"

FACULTY SUPERVISORS OF GRINNELL COLLEGE

By: _____

Printed Name: _____

Grinnell Email: _____

Date: _____

**Any questions regarding this memorandum should be referred to the
Grinnell College Center for Careers, Life, and Service;
1127 Park Street, Grinnell, IA 50112; (641) 269-4940.**