

ORIGINAL VERSION BELOW

GCIEL : VIKING LONGSHIP ASSESSMENT STRATEGY

Project Documentation

Project Members: Nandika Jhunjhunwala, Shreyas Agrawal, Riku Smriga,
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Class: CSC 324 Software Development

Date of Submission: 12/06/2023

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Project Overview

Purpose:

The GCIEL Viking Longship Assessment Strategy project aims to implement an effective assessment strategy for evaluating learning outcomes within a Virtual Reality (VR) game featuring a Viking longship. The primary focus is on leveraging the ARCS model (Attention, Relevance, Confidence, and Satisfaction) to measure motivation and intention in the VR setting. The project seeks to enhance the learning experience for users engaging in the VR Viking Longship building game.

Users:

The primary users of the assessment strategy are educators, game developers, researchers, and students involved in the Viking Longship VR project. The project is also relevant to the general public interested in Viking Cultures as this game is to be deployed in museums in the future as well. Educators will benefit from insights into user behavior and learning outcomes, while game developers can use the collected data for continuous improvement. Researchers and students will have the opportunity to analyze user interactions within the VR environment.

Problem/Data Description:

The VR Viking Longship building game involves users assembling the ship piece by piece, with informational prompts appearing as they interact with each component. The challenge lies in effectively measuring user motivation and intention during gameplay. Key data points include time and distance data on piece by piece ship building, player coordinates, head and eye movements, file interactions, and potential future trajectory datasets. The lack of prior quantitative data and the need for qualitative feedback pose challenges that the project aims to address.

Technology Use:

The project utilizes Unity for VR game development, exporting relevant data for analysis. The data, stored in CSV files, includes X, Y, Z coordinates, as well as player information on position and movement. R is employed for data analysis, visualization, and the creation of a web app to

display the results. The ARCS model guides the integration of motivation and intention metrics into the VR environment, while additional data collection mechanisms and analysis tools are being developed to provide comprehensive insights.

End Product:

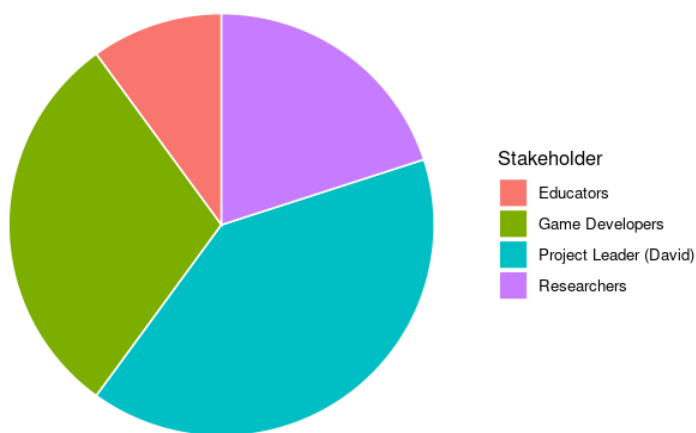
The end product comprises a draft questionnaire aligned with the ARCS model, facilitating the collection of user feedback and insights. Additionally, an RShiny app serves as a visualization tool, offering a dynamic platform for analyzing and interpreting data uploaded by the client. The app aims to enhance the overall assessment strategy by providing actionable information derived from user experiences within the VR game.

Future Directions:

Future directions include the integration of trajectory datasets for analyzing object paths and final states, further data collection mechanisms, and continuous improvement based on qualitative user feedback. The documentation and reporting aspect ensures stakeholders are regularly informed about project progress, outcomes, and potential areas for enhancement.

The GCIEL Viking Longship Assessment Strategy project combines educational assessment methodologies with cutting-edge VR technology, striving to create a holistic and effective learning experience for users engaging with the Viking Longship VR game.

Stakeholder Map



What Works? (Functionality):

Data Collection Mechanisms: The team has successfully identified and implemented data collection mechanisms, including coordinates, head and eye movements, and file interactions. This allows for comprehensive tracking of user behavior within the VR environment.

Draft Questionnaire and RShiny App: The development of a draft questionnaire aligned with the ARCS model and the creation of an RShiny app provide valuable tools for collecting user feedback and visualizing data. These components contribute to a robust assessment strategy.

Data Insights

Simulated User Behavior Analysis: Utilizing mock data, we simulated user behavior analysis within the VR environment. This exercise provided insights into how users might interact with the Viking Longship building game, allowing us to demonstrate the potential analysis of learning strategies.

Consideration of User Familiarity: The mock data enabled us to consider user familiarity with VR by including questions related to prior VR experience. While the data is not real, this consideration is crucial for adapting the VR environment to users' varying levels of expertise.

Analysis of Potential Additional Data: Despite not having real data, we identified potential future data sources such as trajectory datasets and additional player data. This forward-looking approach demonstrates an awareness of the potential for more in-depth analysis and a commitment to expanding the scope of the project.

Transparent Acknowledgment of Challenges: Even with simulated data, we transparently acknowledged challenges, including the absence of specific data (biometric data, Viking ship coordinates) and undecided aspects (type of final visualization). This acknowledgment ensures a realistic assessment of the project's current state and guides future decision-making.

Exploration of Learning Outcomes: Using the mock data, we explored learning outcomes by identifying main educational goals for users and considering the incorporation of Vanessa's rubric into the project. This exercise allowed us to demonstrate how analysis could inform the refinement of both the game and the assessment strategy.

In summary, while we do not have real data, the use of mock data allows us to conduct simulated analyses, providing valuable insights into potential user behavior, learning strategies, and

challenges. This approach serves as a proof-of-concept for the analysis methodologies proposed in the project, guiding future steps with a clearer understanding of the expected impact and outcomes.

Possible Improvements

Data Collection:

- The current version of the app does only allow the users to upload data formatted in CSV. Adding additional functionality that allows users to upload data in other formats would be a great improvement for our app. In addition, adding a function that automatically converts user given data into specific format would also be beneficial in allowing the users to explore with numerous different data.
- The current app asks the users to upload a data file to be read, however, having an option to manually plug in inputs would also be a great extra functionality.
- Furthermore, connecting the app directly with the unity app that is being developed by david to automatically transfer user data from the Game to the R shiny software would also benefit David and his developers teams to explore with newly taken data.

UI & UX:

- The current app uses a certain color palette that may be hard to read for certain users. Although we have tested our app's UI with color accessibility checker websites as suggested by Professor Himenez, it is impossible to meet the needs of all potential users. Thus having an option to let the users change color palette would be beneficial in future versions of the app. In addition, letting users change the character size as well as their format would be a great plus to the accessibility of the app.
- We could also add a better UI in the next version, if there is any, especially adding icons or any other visual aid in explaining what each tab of our app does. Although the app is mainly aimed at being used by Data Engineers and other developers in David's team, adding visual queues hinting what each tab does would add extra usability to the app. For future development we could re-create the entire app using different external UI libraries, which has the potential to custom make the visual queues ourselves.

Visualization and Analysis:

- In addition to our current visualization, having a 3D visualization that shows the heat map of users locations which is directly mapped to the map used in the actual viking game would add extra insights. We currently have a 2D version of this heat map implemented in the app, however, given that the viking game is still under development, the 3D heatmap using the actual in-game map should ideally be implemented after the completion of the game.
- Not only visualization, but also creating an AI model that predicts the users performance based on their personal data would add interesting insights to the developers. With such prediction, David's and his group will be able to fine-tune their app based on the information that the players have provided. For example, if the user has never had past experience with VR before and the AI model suggests strong correlation with in-game experience, the app could add extra tutorials or explanations to those specific users.

Questionnaire:

- The current questionnaire asks users to input their personal information. As David suggested during the final presentation, we will most likely need to change the type of personal information collected depending on where and when the app will be used. For example, if the questionnaire were to be used in Denmark, a country that has strict rules regarding personal data collection, we will need to make changes to the part of the questionnaire that asks the users to input their data. The current version of the questionnaire requires the administrators to manually change the questionnaire itself in order to perform such changes. Having multiple questionnaires depending on the possible use case would be highly beneficial. In addition, using other external applications other than Google Chrome such as Qualtrics may be beneficial in terms of digging deeper into analyzing user data.
- The current version of the app does partially embed the google questionnaire into the app, however, the users currently need to be directed to an external website to complete the questionnaire. We were not able to find a way to fully embed the questionnaire into the app, however, it would be beneficial to either use another questionnaire platform that let us fully embed itself in the R app or to make the entire questionnaire from scratch within the app without using external questionnaires.

Sources

- [1] J. F. Dooley, Software Development, Design and Coding With Patterns, Debugging, Unit Testing, and Refactoring, 2nd ed. Berkeley, CA: Apress, 2017. [Online]. Available: https://grinnell.primo.exlibrisgroup.com/permalink/01GCL_INST/16893lj/alma991010812445604641. Accessed on: Dec. 6, 2023.
- [2] T. Munzner, Visualization Analysis & Design. Boca Raton, FL: CRC Press/Taylor & Francis Group, 2015. [Online]. Available: https://grinnell.primo.exlibrisgroup.com/permalink/01GCL_INST/1g018f9/alma991011039286304641. Accessed on: Dec. 6, 2023.
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- [5] H. Wickham, "Mastering Shiny," [Online]. Available: <https://mastering-shiny.org/index.html>. Accessed on: Dec. 6, 2023.
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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;
- 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;

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 12/15/2023

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”

By: David Neville

Printed Name: _____

Title: Digital Liberal Arts Specialist

Address: HSSC C0426

Email for Notices: nevilled@grinnell.edu

Date: 13 October 2023

“Students”

STUDENTS OF GRINNELL COLLEGE

By: Raj Vardhan Jhanwar, Riku Smriga, Keiichiro Watanabe, Shreyas Agrawal, Nandika Jhunjunwala

Printed Name: Raj Vardhan Jhanwar, Riku Smriga, Keiichiro Watanabe, Shreyas Agrawal, Nandika Jhunjunwala

Grinnell Email: jhanwarr@grinnell.edu, jhunjun@grinnell.edu, smrigari@grinnell.edu, agrawals@grinnell.edu, watanabe2@grinnell.edu.

Date: 10/11/2023

“Faculty Supervisor”

FACULTY SUPERVISORS OF GRINNELL COLLEGE

By: Prof. Priscilla Jimenez-Pazmino

Printed Name: __ Prof. Priscilla Jimenez-Pazmino _____

Grinnell Email: _ jimenezp@grinnell.edu _____

Date: 10/11/2023_____

**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.**

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Raj Jhanwar, Keiichiro Watanabe

Class: CSC 324 Software Development

Date of Submission: 12/06/2023

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Project Overview

Purpose:

The GCIEL Viking Longship Assessment Strategy project aims to implement an effective assessment strategy for evaluating learning outcomes within a Virtual Reality (VR) game featuring a Viking longship. The app was developed by the GCIEL Team. The primary focus is on leveraging the ARCS model (Attention, Relevance, Confidence, and Satisfaction) to measure motivation and intention in the VR setting. The project seeks to enhance the learning experience for users engaging in the VR Viking Longship building game.

Users:

The primary users of the assessment strategy are educators, game developers, researchers, and students involved in the Viking Longship VR project. The project is also relevant to the general public interested in Viking Cultures as this game is to be deployed in museums in the future as well. Educators will benefit from insights into user behavior and learning outcomes, while game developers can use the collected data for continuous improvement. Researchers and students will have the opportunity to analyze user interactions within the VR environment.

Problem/Data Description:

The VR Viking Longship building game involves users assembling the ship piece by piece, with informational prompts appearing as they interact with each component. The challenge lies in effectively measuring user motivation and intention during gameplay. Key data points include time and distance data on piece by piece ship building, player coordinates, head and eye movements, file interactions, and potential future trajectory datasets. The lack of prior quantitative data and the need for qualitative feedback pose challenges that the project aims to address.

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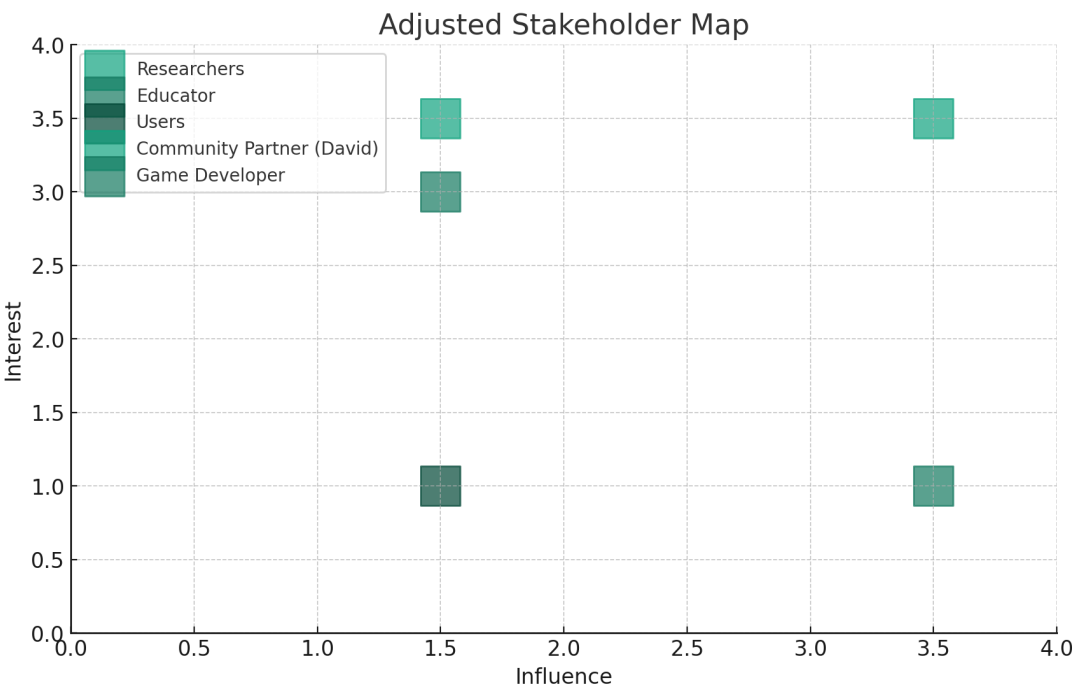
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Future Directions:

Future directions include the integration of trajectory datasets for analyzing object paths and final states, further data collection mechanisms, and continuous improvement based on qualitative user feedback. The documentation and reporting aspect ensures stakeholders are regularly informed about project progress, outcomes, and potential areas for enhancement.

The GCIEL Viking Longship Assessment Strategy project combines educational assessment methodologies with cutting-edge VR technology, striving to create a holistic and effective learning experience for users engaging with the Viking Longship VR game.

Stakeholder Map



What Works? (Functionality):

Data Collection Mechanisms Functionality:

The system is designed with advanced data collection functionalities that encompass the acquisition of coordinates, head and eye movements, and file interactions. This feature set enables a sophisticated tracking of user behavior within the VR environment, offering an in-depth analysis of user engagement and interaction patterns.

Functionality of Draft Questionnaire and RShiny App:

Our development includes a draft questionnaire that is tailored to the ARCS model, enhancing the process of gathering user feedback. Alongside, the RShiny app stands out as a key software feature. It is not just a tool for data collection, but also excels in visualizing the gathered data. These elements collectively form a comprehensive assessment strategy, allowing for an effective visualization and interpretation of user responses and behaviors.

What insights did you get from your data?

Simulated User Behavior Analysis: Utilizing mock data, we simulated user behavior analysis within the VR environment. This exercise provided insights into how users might interact with the Viking Longship building game, allowing us to demonstrate the potential analysis of learning strategies.

Consideration of User Familiarity: The mock data enabled us to consider user familiarity with VR by including questions related to prior VR experience. While the data is not real, this consideration is crucial for adapting the VR environment to users' varying levels of expertise.

Analysis of Potential Additional Data: Despite not having real data, we identified potential future data sources such as trajectory datasets and additional player data. This forward-looking approach demonstrates an awareness of the potential for more in-depth analysis and a commitment to expanding the scope of the project.

Transparent Acknowledgment of Challenges: Even with simulated data, we transparently acknowledged challenges, including the absence of specific data (biometric data, Viking ship coordinates) and undecided aspects (type of final visualization). This acknowledgment ensures a realistic assessment of the project's current state and guides future decision-making.

Exploration of Learning Outcomes: Using the mock data, we explored learning outcomes by identifying main educational goals for users and considering the incorporation of Vanessa's rubric into the project. This exercise allowed us to demonstrate how analysis could inform the refinement of both the game and the assessment strategy.

In summary, while we do not have real data, the use of mock data allows us to conduct simulated analyses, providing valuable insights into potential user behavior, learning strategies, and

challenges. This approach serves as a proof-of-concept for the analysis methodologies proposed in the project, guiding future steps with a clearer understanding of the expected impact and outcomes.

What needs improvement?

Data Collection:

- The current version of the app does only allow the users to upload data formatted in CSV. Adding additional functionality that allows users to upload data in other formats would be a great improvement for our app. In addition, adding a function that automatically converts user given data into specific format would also be beneficial in allowing the users to explore with numerous different data.
- The current app asks the users to upload a data file to be read, however, having an option to manually plug in inputs would also be a great extra functionality.
- Furthermore, connecting the app directly with the unity app that is being developed by David to automatically transfer user data from the Game to the R shiny software would also benefit David and his developers teams to explore with newly taken data.

UI & UX:

- The current app uses a certain color palette that may be hard to read for certain users. Although we have tested our app's UI with color accessibility checker websites as suggested by Professor Jimenez, it is impossible to meet the needs of all potential users. Thus having an option to let the users change color palette would be beneficial in future versions of the app. In addition, letting users change the character size as well as their format would be a great plus to the accessibility of the app.
- We could also add a better UI in the next version, if there is any, especially adding icons or any other visual aid in explaining what each tab of our app does. Although the app is mainly aimed at being used by Data Engineers and other developers in David's team, adding visual queues hinting what each tab does would add extra usability to the app. For future development we could re-create the entire app using different external UI libraries, which has the potential to custom make the visual queues ourselves.

Visualization and Analysis:

- In addition to our current visualization, having a 3D visualization that shows the heat map of users locations which is directly mapped to the map used in the actual viking game would add extra insights. We currently have a 2D version of this heat map implemented in the app, however, given that the viking game is still under development, the 3D heatmap using the actual in-game map should ideally be implemented after the completion of the game.
- Not only visualization, but also creating an AI model that predicts the users performance based on their personal data would add interesting insights to the developers. With such prediction, David's and his group will be able to fine-tune their app based on the information that the players have provided. For example, if the user has never had past experience with VR before and the AI model suggests strong correlation with in-game experience, the app could add extra tutorials or explanations to those specific users.

Questionnaire:

- The current questionnaire asks users to input their personal information. As David suggested during the final presentation, we will most likely need to change the type of personal information collected depending on where and when the app will be used. For example, if the questionnaire were to be used in Denmark, a country that has strict rules regarding personal data collection, we will need to make changes to the part of the questionnaire that asks the users to input their data. The current version of the questionnaire requires the administrators to manually change the questionnaire itself in order to perform such changes. Having multiple questionnaires depending on the possible use case would be highly beneficial. In addition, using other external applications other than Google Chrome such as Qualtrics may be beneficial in terms of digging deeper into analyzing user data.
- The current version of the app does partially embed the google questionnaire into the app, however, the users currently need to be directed to an external website to complete the questionnaire. We were not able to find a way to fully embed the questionnaire into the app, however, it would be beneficial to either use another questionnaire platform that let us fully embed itself in the R app or to make the entire questionnaire from scratch within the app without using external questionnaires.

Sources or References in IEEE format

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- [5] H. Wickham, "Mastering Shiny," [Online]. Available: <https://mastering-shiny.org/index.html>. Accessed on: Dec. 6, 2023.

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Appendix: Memo of Understanding.

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;
- 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;

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 12/15/2023

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: _____ Email for
Notices: n_e_v_i_l_e_d@_g_r_i_n_n_e_l_l_.e_d_u _____

Date: _____
Date: 1_3_O_c_t_o_b_e_r_2_0_2_3 _____

"Students"

STUDENTS OF GRINNELL COLLEGE

By: Raj Vardhan Jhanwar, Riku Smriga, Keiichiro Watanabe, Shreyas Agrawal, Nandika Jhunjunwala

Printed Name: Raj Vardhan Jhanwar, Riku Smriga, Keiichiro Watanabe, Shreyas Agrawal, Nandika Jhunjunwala

Grinnell Email: jhanwarr@grinnell.edu, jhunjun@grinnell.edu, smrigari@grinnell.edu, agrawals@grinnell.edu,
watanabe2@grinnell.edu.

Date: 10/11/2023 _____

"Faculty Supervisor"

FACULTY SUPERVISORS OF GRINNELL COLLEGE

"Community Partner"

By: D_a_v_i_d_N_e_v_i_l_l_e _____

Printed Name: _____

Title: D_i_g_i_t_a_l_L_i_b_e_r_a_l_Ar_t_s
S_p_e_c_i_a_l_i_s_t _____

Address: H_S_S_C_C_04_26 _____

By: Prof. Priscilla Jimenez-Pazmino

Printed Name:___ Prof. Priscilla Jimenez-Pazmino _____

Grinnell Email: _jimenezp@grinnell.edu _____

Date: 10/11/2023_____

**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.**