Project Title: Augmented Reality Sandbox
Department/Organization: Geology
Project Applicant(s):
Principal Contact
Name: Ben Paulson  MS 9080  Email: Ben.paulson@wwu.edu  Phone 3585
Others
Name: Brady Foreman  MS 9080  Email: Brady.Foreman@wwu.edu  Phone 2546
Name: Doug Clark  MS 9080  Email: Doug.Clark@wwu.edu  Phone 7939

Amount Requested for Project
Proposed Budget:
1. Equipment total $5426
2. Plus site preparation (not STF funded) + $1200
3. Total Project Cost (spreadsheet total from part IV of this form, Total Project Budget) = $6626
4. Less organization’s contribution – $0
5. Less site preparation – $1200
6. STF Grant Request = $5426

IMPORTANT NOTE
1. THE STF Committee will accept only complete proposals by the announced deadline. Every section (I–IX) and all items of this proposal format must be addressed.

I. Relationship to STF Objectives / Impact on Current Academic Programs
The STF Committee will use as its primary assessment criteria the three objectives—quality, access, and integration—defined in the STF mission (above). Given this criteria, describe your proposed project in detail.

1. Tell us—focusing on what the students would gain from the project—how the project would provide positive benefits to specific courses or instructional programs. Specifically, answer at least one of a, b, and c below:

   a. How would this project broaden or enhance the quality of the student’s academic experience through the proposed technology?

   The proposed Augmented Reality (AR) Sandbox will allow students, interactively and in real time, to see how changes in 3-D topographic surfaces are represented in two dimensions. The AR Sandbox is a hands-on, active learning tool that allows direct interaction with technology that demonstrates important geomorphological concepts.
as well as how those geomorphic concepts are represented as topographic features on a map. Moreover, experiments and activities with the AR sandbox will yield important insights into 3-D visualization and translation into 2-D data and maps. This is one of the most difficult concepts and intellectual hurdles many students face (i.e., how to mentally switch back and forth between 2nd and 3rd dimensions). The AR sandbox allows students to manipulate 3-D Earth surfaces and project constantly-updating 2-D contour lines and elevation color maps onto the surfaces. This skill is integral to the study of geology, and this new technology is arguably the best means to teach student this important skill.

b. How would this project **provide additional student access** to technological resources?

An AR Sandbox is a system that allows students to directly create topographic features by shaping real sand. Then, by using a Microsoft Kinect 3D camera, specially developed visualization software, and a data projector, the sand surface is augmented in real time with a color-shaded elevation map and contour lines. The AR Sandbox visualization software can project simulated water that has the ability to "flow" based on the represented topography.

Overall this project would enhance the quality of and instructional impact of numerous labs and provide a powerful 3D visualization tool that teaches and reinforces geologic, geographic, and hydrologic concepts. Additionally, this project would complement recent and ongoing upgrades to the Western Experimental Earth Surface Laboratory housed in the Environmental Studies building (ES60). The laboratory includes a large wave tank that simulates beach processes and stream tables that simulate river and deltaic systems.

The AR Sandbox was originally developed at UC Davis as the result of an NSF-funded project on informal science education for freshwater lake and watershed science. Since the initial creation, there are now more than 100 AR Sandboxes in the United States at various universities and museums.

c. How would this project **increase integration** of technology into coursework?

The project will directly impact several existing courses in the Geology Department including Geol 101, 211, and 310. Several sections of these courses are offered throughout the academic year, and in any given year approximately 1300 students from just Geol 101 would make use of the AR Sandbox. We anticipate that other courses will make use of the AR Sandbox (e.g., Geol 212, 318 and 430/530, representing an additional 250-270 students per year) and perhaps courses from other departments (e.g. SCED 202) may find ways to implement use of an AR Sandbox.

In addition to improving existing course modules, new laboratory projects and lecture examples will be possible with an AR Sandbox. Moreover, the AR Sandbox could also be used in pedagogical development assessing the effectiveness of augmented 3D experiments in student learning through collaboration with SMATE researchers.

We propose to have the AR Sandbox located in the Atrium on the first floor of the Environmental Studies building. Not only will the AR sandbox be close to the Geol 101 labs, but the AR sandbox will also be available to the public. The AR Sandbox is a hands-on tool that can be used with little supervision and requires minimal maintenance and upkeep. The AR sandbox would complement existing exhibits in the ES building that bring in as many as 1000 community members of all ages in any given year. In fact, hundreds of K-12 students visit the Geology Department’s displays yearly and the addition of the AR sandbox will surely help to foster interest in science in general, and geology in particular.

To really demonstrate the power of this technology, please watch this short video of an AR sandbox in action: https://www.youtube.com/watch?v=CE1B7tdGCw0
2. Would other departments be involved with this project?
   - No [X]  Yes [□]  If yes, describe.

3. Has any part of this project previously been funded by the Student Technology Fee?
   - No [X]  Yes [□]  If yes, describe.

4. Is the proposed project a pilot project?
   - No [X]  Yes [□]  If yes, describe.

II. Utilization

List the anticipated number of times and duration per each use—per quarter or per academic year—that students would use the proposed technology. The committee is looking for total student hours and total number of unique students who would use the technology in that time period. Explain how you arrived at this utilization.

Approximately 1800 unique students PER YEAR
Approximately 2500 hours PER YEAR

The AR sandbox is a powerful learning tool that will be incorporated into several existing geology classes, which means there will be several unique users that will spend at least an hour per user. If we consider just Geology 101, we currently have 1300 unique students per academic year who are enrolled in Geology 101. Each of those users would spend an hour using the AR sandbox. That would work out to be 1300 hours of use per academic year for just Geology 101. Considering all geology classes, we could easily be utilizing the AR sandbox for 2500 student contact hours per academic year for just instruction. This estimation does not include students that may use it from other departments (e.g. SMATE, ESCI) nor does it include independent research projects that may be undertaken by undergraduate researchers where they could spend up to 80 hours using the AR sandbox.

Geol 101 (taught every quarter): 1300 students, 1 hour each (1300 student hours (sh))
Geol 211 (taught every quarter): 75 students, 2 hours each (150 sh)
Geol 212 (taught every quarter): 120 students, 3 hours each (360 sh)
Geol 310 (taught every quarter): 75 students, 4 hours each (300 sh)
Geol 318 (taught every quarter): 120 students, 2 hours each (240 sh)
Geol 413/513 (taught every other year): 20 students, 4 hours each (80 sh)
Geol 415 (taught every quarter): 60 students, 3 hours each (180 sh)
Geol 424/524 (taught approximately every other year): 15 students, 3 hours each (45 sh)
Geol 428/528 (taught approximately every other year): 15 students, 3 hours each (45 sh)
Geol 430/530 (taught once per year): 20 students, 2 hours each (40 sh)

III. Project Budget

This section details the estimated total cost of the project. Include costs that would be covered—by your department or another source—for ongoing costs such as personnel or operating expenses.
1. For assistance in preparing your budget, please consult with relevant campus support departments (Academic Technology & User Services, Budget Office, Purchasing, Space Administration, etc.).

2. For more information about these contacts and helpful tools/links: from the STF website home page (http://www.wwu.edu/stf), choose “STF Tech Initiatives” on sidebar, then section “II. Tech Initiatives Forms and Instructions.”

Attach an Excel spreadsheet if you have additional details.

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*This budget total (or your attached spreadsheet total) should match the projected budget figure on page 1 of this proposal. (See box on page 1, line 3.)*

Important Notes from the STF Committee:

- We recognize your proposed budget as an estimate. Final funding for successful projects will be established after thorough technical review; some costs may need adjusting due to price changes.

- We recommend that you include a 3 percent cushion to allow for price increases.

- We may impose special conditions on a proposal before approval. See STF Proposal Guidelines.

- Funding is not provided directly to departments for purchases. All purchasing is done via the Office of the VPIT/CIO and savings are retained in the Student Technology Fee fund.

3. What funding or contributions are available from your department or other sources?

**Note:** “Contribution” is defined as a monetary contribution. A vendor discount, for example, is not considered a contribution.

Yearly upkeep and maintenance costs.

4. Could this project be divided into discrete elements that could be funded separately?

**Note:** A “no” response to this question creates an “all or nothing” proposal. That is, if the STF Committee decides against funding your entire proposal, it will not consider any elements for
partial funding. If elements could be funded separately, the applicant is responsible for prioritizing them before submitting the proposal.

No ☒ Yes ☐  If yes, summarize and prioritize project elements with cost estimate for each.

5. Are course or lab fees charged for any of the courses that will use this equipment?

No ☐ Yes ☒  If yes, describe. Please note: The total funding requested from the Student Technology Fee must reflect the amount collected from course fees for equipment replacement and/or equipment acquisition.

Lab fees are primarily used to replace and upkeep existing equipment and replace rock, mineral, fossil specimens and other samples used in instruction. Lab fees could be used for basic upkeep, but there is not enough to cover the cost of new durable equipment.

IV. Impact on Existing Resources

Your proposal must address the project’s potential impact on existing resources. Give special attention to the impact on data transmission networks (e.g., sources accessed, networking equipment, etc.), and personnel (e.g., staffing, administrative support, faculty support, etc.).

1. Describe how existing equipment is used. Contrast this to projected use if your project were funded.

   We currently use static 3D block models to show topographic features as well as static 3D plastic topographic maps to show the translation of 3D features into 2D representation. The AR sandbox will allow quantitative examination of topographic development and translation into the topographic maps students use during fieldwork and field trips and eventually within their careers.

   While the AR sandbox computer will be networked, it will not have a measureable impact on the data transmission network. The internet is needed to keep the computer updated, divers for hardware updated, and for use of security cabling. The computer will not be accessible to users of the AR sandbox.

2. Is similar equipment or technology available elsewhere on campus—such as the Student Technology Center, Classroom Services, Video Services, Western Libraries, a college lab?

   No ☒ Yes ☐  If yes, describe why the existing equipment does not meet the needs outlined in this proposal.

3. If this project involves the replacement of equipment, including computers:
   a. Describe the “before and after” configuration changes. (A spreadsheet reflecting these changes may be attached.) Or, write “N/A.”

      n/a
   b. Describe the costs and benefits of replacing vs. upgrading. Or, write “N/A.”

      n/a

4. Would this equipment be available to students outside of your department?

   No ☐ Yes ☒  If the proposed technology would be used by students outside of your department,
describe how they would gain access, how equipment availability would be publicized, the hours/week when equipment would be available, and any costs that would apply.

The AR sandbox would be housed in the atrium on the first floor of the Environmental Studies building - which is accessible during normal building hours.

5. Does this project involve the check-out of equipment to students?

No ☐ Yes ☑ If yes, discuss whether or not the Student Technology Center/ATUS Loan Pool could be assigned this task.

6. Does the department have adequate operating funds to provide ongoing maintenance and support?

No ☐ Yes ☑ If yes, describe.

The upkeep costs are expected to be minimal perhaps less than $50 per year.

7. Does the department have adequate personnel funds to provide ongoing staff support for the project?

No ☐ Yes ☑ If yes, describe.

Upkeep of AR sandbox will not require additional personnel funds, and any upkeep will be minimal and not impact current staff's ability to perform normal duties.

V. Space and Site Information

This section addresses any space alteration or site preparation necessary for the proposed project. Site alterations include painting, holes in walls, security systems, carpeting, construction, lighting changes, or conversion of a lab or office.

Special Note: If this project would require any site preparation, or if this project would use any space not currently under your department’s control:


b. Space Administration and Facilities Management will then conduct a site survey and respond to you by March 24, 2017 about project feasibility, cost, and schedule.

c. You must include the site survey response with your final proposal.

1. Location for installation of equipment or technology:

   Environmental Studies Building Atrium

2. Would site modification be required?

   No ☐ Yes ☑ If yes, describe the modifications (e.g., electrical, air, painting, lighting, security, network access, etc.).

   Installation of approximately 8 linear feet conduit to route internet access for security cabling.

3. Would this project use space not currently assigned to your department or area?

   No ☐ Yes ☑ If yes, describe.
The proposed AR Sandbox would be on display in the atrium on the first floor of the Environmental Studies building. The AR sandbox has a 4’ x 3’ footprint and would complement existing public displays in the ES building.

VI. Project Schedule

Describe your overall implementation schedule. (Remember that project awards are announced during spring quarter, and that projects are to be substantially completed by the end of the calendar year.) If any site preparation is involved (see section VI above), align your project schedule with the schedule provided by Space Administration and Facilities Management.

Once funding is acquired, materials and electronic components will be purchased, sandbox will be assembled, and once conduit has been installed for internet access to provide security cabling, the AR sandbox can be programmed and will be available for use. I anticipate that in all it will be less than a month after facility work is completed to have the AR sandbox constructed and operational.

VII. Constraints

List or describe any external or internal factors/constraints that could affect your project schedule, project objectives, or the project budget (e.g., if external approval is required for curricular changes, or if funding must be received by a certain date).

The project schedule would be constrained by the availability for Facilities to install the conduit needed for internet access. Internet access is only needed for security cabling.

VIII. Submitting the Proposal

1. Make sure your proposal does not exceed 12 pages (not including Tech Initiatives Summary Sheet).

2. Complete top portion of a 2017 Tech Initiatives Proposal Summary Sheet for the front of the proposal.

3. (for proposal submitters) Electronically submit Word versions only of the proposal and summary sheet for prioritizing:
   a. Students: Submit by March 30 to AS VP for Academic Affairs at asvp.academics@wwu.edu.
   b. Faculty and staff: Submit by internal due date, per your unit’s process, which must be before proposal due date of April 3.

4. Submit prioritized proposals:
   a. (student proposals)
      AS VP for Academic Affairs: Ensure AS President approval and priority are on Summary Sheet, then email proposal (Word version only) and summary sheet (PDF version only) to diane.bateman@wwu.edu (the STF Committee secretary) no later than April 3.
   b. (faculty and staff proposals)
      College Dean/unit head: Ensure appropriate approvals and priority are on Summary Sheet, then email proposal (Word version only) and summary sheet (PDF version only) to diane.bateman@wwu.edu (the STF Committee secretary) no later than April 3.

Note: Paper copies of proposals are no longer required; please do not send.