Proposal for Adoption

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For the past 3 years, Abilene Christian University's Innovation Foundry has been exploring the benefits of virtual reality (VR) to teaching and learning. Scaling any of our efforts has been a challenge, mostly due to the cost of VR hardware and software. This proposal will recommend using 3D assets created through photogrammetry for use with augmented reality.

Photogrammetry and Augmented Reality

Photogrammetry is the process of making measurements through the analysis of photographs (McCarthy, 2014). With the use of special software, multiple photos can be taken around an object and combined to make a digital 3D model. Augmented reality (AR) is "a technology in which real-world objects and virtual objects are combined with simultaneous interaction" (Sirakaya & Cakmak, 2018, p. 298). AR is well recognized through mobile apps like Pokemon Go, but companies like Amazon use AR to show what furniture would look like in your house.

The fit of AR in Anatomy and Physiology at ACU

Anatomy and Physiology labs use large, expensive, physical 3D models of various parts of the human anatomy to help students visualize the various parts of an organ or body system. At ACU, I want to create digital 3D anatomical models of the exact physical models used in anatomy and physiology labs. These 3D models would be made available to students in a web browser or in augmented reality from a mobile device. By allowing students to use the same models at home used in class, they use repetition to study the parts of the human body, like the heart, brain, or cells, increasing their likelihood of retaining that information.

Advantages and disadvantages

A couple of the advantages of using augmented reality in higher education are to increase

learner outcomes and to improve student-material interactions. AR increases learner outcomes by enhancing learning achievement and motivation and helping students better understand the content (Sirakaya & Cakmak, 2018, p. 6). AR improves student-material interactions by giving students additional access to material they might not otherwise have when they leave the classroom. Courses that use expensive, physical 3D models in class (e.g. anatomy and physiology) require students to use 2D models (flat images) that are available in a textbook for further studying. Digital 3D models available in AR allow students to take home a digital version of the expensive anatomical models used in labs. AR is also more accessible than VR because it typically only requires a smartphone (Brown, et al., 2020).

The main disadvantages are the technical skills required to create the 3D models from photographs. Photogrammetry requires knowledge of photography and lighting to create high-quality 3D models. The software applications available to create 3D models through photogrammetry are not intuitive for the average user.

Strategies of implementation

To implement this into anatomy and physiology labs at ACU, the Innovation Foundry would need to:

1) purchase lighting and staging equipment and a digital camera;
2) Work with the A&P professors to choose which models to use;
3) Take photos of the physical models;
4) Edit the photos to ensure proper exposure;
5) Import photos into photogrammetry software, like Metashape, and create and export a digital 3D model;
6) Upload the models created to SketchFab;

7) Share links to the 3D models from Sketchfab.

Implications for practice in adoption

Because of the rising costs of education, higher education institutions need to increase the value of the educational experience (Brown, et al., 2020). Faculty can increase this learning experience by using effective technologies that allow students to engage in higher-order thinking during class instead of spending a significant amount of time on basic knowledge and memorization. This frees up time for faculty to spend more time on difficult concepts like physiology.

Growth of XR

"XR technology quickly improved in realism and accuracy while its costs decreased steadily, making it available to a much wider student audience" (Brown, et al., 2020, p. 33). While it is true that the decrease in the cost of virtual reality makes it more affordable and available to students, we have found the amount of educational VR content is significantly lacking.

Emerging technologies and practice questions

1. Thinking about the probability that this tech or practice will succeed or fail at the institution, how would you rate the level of risk involved in adopting AR?

I believe this project has a fairly low risk of adopting AR. The estimated cost would be around $1500 for a camera, lighting, and software to start out at a small scale of one course.

2. Relative to institution size and budget, how much institutional spending would you anticipate would be required to adopt AR across the curriculum?

The ACU Innovation Foundry usually has $2000-4000 each year in funding for technology that might be needed. In order to expand the use of AR across the curriculum, there would not be a

need for additional equipment, but the creation of the 3D models would require a significant amount of time. We may need to hire student workers to keep up with the demand for 3D models. This need would grow as the adoption rate increased.

3. Overall, how receptive would you say faculty would be to adopting AR?

I believe that many faculty would be hesitant because they are not as familiar with AR and how it might benefit their students. However, there may be many who are open to trying it, especially because they do not have to do very much in terms of creating the models.

References

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