# Immersive Visualization Technologies to Facilitate Multidisciplinary Design Education

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# Background

- The College of Architecture and Design at the University of Houston offers undergraduate and graduate degrees in architecture, interior architecture, and industrial design.

- Faculty and students work together in a studio-centric curriculum, supported by a fabrication facility.

- Open studios seamlessly incorporate coursework into project-based learning through material investigations and applied research.

# Background

- In Spring 2016, the College decided to sponsor an Interdisciplinary Course program.

- Courses had to be defined in interdisciplinary terms that encourage participation of students from the three disciplines.

- Course enrollment between 10 and 20 students.

- Courses should include an element of introspection about the interdisciplinary experience, and whether students from the 3 different majors approach the material differently.

- Studio and project-based courses, highly encouraged.

# Interdisciplinary Education

- Collaborators from multiple disciplines work together on a problem and each collaborator brings his or her own expertise to the team.

- Popular approach in many undergraduate programs.

- The integration of various disciplines into an interdisciplinary curriculum is generally implemented as project-based team courses which emphasize teamwork as the focus for learning.

- In some cases, students work closely with sponsors and external companies that support the course

# Interdisciplinary Education. Challenges

- Fragmentation of disciplinary information

- Inability to digest the extensive volume of existing information

- Lack of access to relevant information

- The unique characteristics of each design discipline make it difficult to deliver an integrated curriculum that promotes truly interdisciplinary work

# Interdisciplinary Course

- Course: Emerging Visualization Technologies

- Advanced 3D visualization tools that can be used to present and experience design information, concepts, and outcomes in an immersive manner.

- The course emphasizes:

  - 3D visualization, presentation, and visual communication as fundamental skills that are common across different specialties;

  - the integrative and versatile nature of visualization technologies

  - the inherent applicability to different design fields.

# Topics

- The course is divided into four major learning blocks

  - Fundamentals of 3D visualization

  - Augmented Reality

  - Virtual Reality

  - Holographic Visualization

- Students investigate how 3D visualizations can enrich the delivery of design information; enhance presentations and simulations in their respective fields, and impact user perception, cognition, and engagement.

# Topics

- Topics and technologies were discussed almost entirely from a content-creation point of view, emphasizing user experience.

- Emphasis was put on the quality of the deliverables.

- No programming, software development, or computer graphics concepts were discussed beyond basic interactions and interface design.

# Equipment



Microsoft Hololens



Oculus Rift

# Team Projects

- A team project was assigned for each major topic.

- Teams were comprised of no less than three students.

- Attempts were made to diversify all teams so at least one member of each team would be from a different design discipline.

- Projects involved the creation of an interactive visualization experience that combined elements of all three majors.

- The experience would be designed for the specific technology being discussed in class at the time the project was assigned.

# Team Projects

- As an example, for virtual reality, an architecture student may create an immersive visualization of a building where all the details can be experienced at true scale.

- Similarly, an interior architecture student may build on the previous work by modeling a particular interior space within the previous building,

- An industrial design student could do the same for a particular piece of furniture for that interior space.

- All three concepts are integrated in a seamless manner to provide a comprehensive visualization of a particular design space.

# Team Projects

- The final deliverables for each project required a report, an oral presentation, and a demonstration of the experience.

- Project topics were discussed between the faculty and each individual team and reflected the interests of the students.

# Team Projects

- **Augmented Reality**: *Hotel*

    o Architecture: Hotel Building

    o Interior Architecture: Lobby Area

    o Industrial Design: Furniture

- **Holographic Visualization (Hololens)**: *Museum*

    o Architecture: Building

    o Interior Architecture: Exhibit Room

    o Industrial Design: Information Kiosks

- **Virtual Reality (Oculus)**: *Virtual Houston*

    o Architecture: Downtown Houston

    o Interior Architecture: Office Space

    o Industrial Design: Lighting and lamps

# Projects

# Discussion

- Students benefit from exposure to a diversity of design backgrounds from their colleagues and opportunities to share their areas of expertise within their groups.

- Students also benefit from explicit instruction on cross-disciplinary teamwork, dynamics, and problem solving.

- Students get different perspectives on design by interacting with other students and being exposed to how other disciplines approach the design process itself.

- Students benefit from the resulting project outcomes, which provide an integrated piece for their creative design portfolios.

# Drawbacks

- Lack of particular resources dedicated to the teams was unfortunate, as all specialized equipment had to be shared among multiple teams.

- Major obstacle for students: Oculus Rift and the Microsoft Hololens are costly and require powerful computers to run.

- Even a small budget to purchase more equipment could have been helpful.

- An alternative option was proposed where each team would complete each project at a different time during the semester to reduce scheduling conflicts for a specific device.

# Thank you for your attention.

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