Teaching Serious Game App Design Through Client-based Projects

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ABSTRACT

This paper explores mobile game development courses conducted during the 2012/2013 academic year at George Mason University. In the courses, students had to design mobile games for clients. Each design group of five students was responsible for developing a game that would address the clients' goals. Throughout each course students developed mobile game prototypes and, eventually, an alpha build of the proposed mobile game on a phone or tablet.

This paper explores the effectiveness of studio courses in embodying the game design process over individual tool-based courses. It examines the effectiveness of an immersive client-based design project at demonstrating development issues to students. Lastly, it explores how such courses can fit into a Game Design curriculum while still addressing specific Serious Game issues. Through the exploration proposed, educators can consider whether the challenges, surprises, and management issues inherent in client-based projects are worth wider adoption.

Keywords

Serious Games, game design pedagogy, mobile games, mobile apps, client-based projects, curriculum development

INTRODUCTION

As a field of design in which a student may earn an undergraduate or graduate degree, Game Design is showing itself to be one of the more complex to study. The International Game Developers Association's 2008 Curriculum Framework for Game Design programs is forty-four pages long and includes topics ranging form visual design and programming (2008, 7) to Architecture (2008, 23) and Theatrical Performance Theory (2008, 25.)[1] Likewise, Jesse Schell's *The Art of Game Design, A Book of Lenses*[2] cites nineteen fields that "successful game designers" (2008, 2–4) must understand, including business, economics, psychology, and others—each a field in which students could earn a full degree.

Forming a college curriculum from this broad range of topics is a challenge facing the over three hundred Game Design schools listed by the Entertainment Software

Association (ESA) in 2010[3] and the over five hundred listed by GameCareerGuide.com in 2012.[4] Added to these growing pains are the challenges of balancing theoretical notions of Game Design against the necessity of teaching industry-standard software packages and handling students' preconceived notions of games and game-making. However, Game Design distinguishes itself from other fields of design by allowing students to actually produce the products they are studying: students in Game Design programs create playable games.

The creation of playable game products is at the center of George Mason University's Mobile Game Design courses, in which students create Serious Game Applications for clients from the Washington, DC and Northern Virginia areas—lobbying groups, government offices, and others. Implemented during the 2012–2013 academic year, these courses ask students, in development teams of five, to address the clients' goals through their game proposals, which are then developed into launchable mobile applications. As such, students had to tailor everything in the game—art and sound assets, game mechanics, reward systems, and so forth—to embody a client's message to specific audiences.

Student and Methodology Overview

The course took several risks with the mix of students. Fall enrollment for the course was comprised of 47% second year, 41% third year, and 12% fourth year students. Many of these students also had a focus on Game Art or Design rather than Game Programming and Development. Going in, it was unclear how such young students would respond to an intensive project with real-world delivery expectations. These students had also not had a formal programming class at this point in the curriculum, so one of the goals was to see how they would respond to learning scripting on the fly (Totten, 2012)[5]. It was decided that the Fall students would focus on a game project for the entire semester, so the form of learning researched here was a Constructivist "immersion" approach. Under this model, students developed their project in the Unity engine in preparation for regular faculty and client feedback. The design for this course involved students learning design principles less from lectures and more from applied development situations as they worked on games. Likewise, there was less time spent on traditional "tutorial" sessions for development software, with a greater focus on learning by developing their specific projects. These methods were chosen for the fall project to test students' ability to self-teach and problem-solve while allowing maximum creative freedom in the type of games they wanted to create for the client.

The spring enrollment for the course was comprised of even percentages of first and second year students—27.3% each—with the other 45.5% comprised of third year students. Like the students from the fall semester, they had little formal training in programming or design coming into the semester and were focused mainly on the art and design aspects of the field. Likewise, they had not worked on a project with real-world expectations outside of class performance to this point. For this class, it was decided that the semester would be divided into a first half focusing on design theory lectures and software tutorials, and a second half working on the client project. The theory lectures involved study of current trends in Mobile Game Design and analytical play sessions of games. Tutorials involved overviews of the Unity engine and demonstrations of how common game mechanics could be created through scripting. While guidance for students was greater, there was also less time to focus on the client project.

Description of Clients and Project Expectations

As stated previously, each semester's student project was focused on developing games for a client in the DC-Metro or Northern Virginia area. This allowed teachers and project managers to steer students in responding to a specific design brief rather than open-ended design projects where students could choose their game's content. This section describes the clients for each semester, their project goals, and examples of games that were developed for these organizations.

The Century Council

The fall semester client was The Century Council, a not-for-profit organization that fights drunk driving and encourages responsible decision-making. For this project, students were given a lot of freedom in the type of game they could develop as long as it discouraged alcohol use and promoted healthy lifestyles. Two versions of the game app would be created: one for players aged six to nine and another for players aged nine to fifteen. It was asked that the games for the younger demographic feature less-explicit alcohol consumption, instead relying on healthy lifestyle messages.

In this case, the client's message would be conveyed in a variety of ways. The students were in charge of developing game mechanics and art that would embody the Century Council's anti-alcohol mission to promote healthy living and good decision-making among minors. Meanwhile, the Century Council specifically asked for students to include quiz sections in their games where players would have to answer questions about healthy living and underage drinking. This mix of freedom of gameplay and specificity of message created a wide range of portrayals. For example, one group portrayed ideas of positive and negative peer pressure through a game based on *Phage Wars* (joeybetz, 2009)[6], where players are microorganisms competing to influence cells around them. The student game, *Pressure Network*, featured middle and high school students who could influence students around them with messages not to drink. Likewise, another group created an endless runner-style game called *Dizzy Dash* in which players must steer a brightly colored character that is always running forward; collecting unhealthy items make the character harder to control. This game for the six-to-nine demographic taught about alcohol abstractly but maintained the same message.

The Center For Advancing Correctional Excellence (ACE!)

The spring semester client was George Mason University's Center for Advancing Correctional Excellence (ACE). This organization addresses issues in the criminal justice and health fields through cross-disciplinary research and collaboration with policymakers. For this project, students were given a specific mission: develop a game-like mobile application that enforces self-improvement goals for people on probation. The goals are based on assessments that probationers complete in the presence of their probation officers. ACE provided assessment content in the same way that the Century Council provided questions for players to answer. Each ACE game had to also allow players to contact probation officers in emergencies and access motivational YouTube videos of people who had successfully passed through the probation process.

Initially, students felt that they had little freedom to design their games. However, studies of design precedents such as *SuperBetter*[7] (SuperBetter Labs, 2012) and *Fitocracy*[8] (Fitocracy, 2011) demonstrated that similar gameplay systems could have varied themes. As such, students each pursued game applications that gave in-game rewards for real-world achievements based on the probationer's unique needs. While each game had systems for setting goals and earning rewards, groups created projects that framed this

process through different narratives. For example, *Onward* frames each goal as a quest in a fantasy role-playing game. As players earn in-game points for their real-world accomplishments, they can explore increasingly beautiful landscapes and earn new abilities. Likewise, *Ascension* turns real-world positive behaviors into tools and parts for an interstellar spaceship that can reach more distant planets as the game progresses. These games and others highlight the other featured content, contact buttons, and motivational videos as elements on every screen so that players do not have to search for these functions in emergencies. Above all, ease of use and friendly feedback were essential in creating games for this project.

Curriculum Investigation Questions

In a context broader than the projects specifically created at George Mason, project-based courses and client integration like those described above provide opportunities to embody the game design process more directly than isolated software courses or student-conceived game projects. Immersive client-based design projects also better demonstrate real-world development issues, such as last-minute design changes, project theming, cross-disciplinary communication, and asset integration.

Important pedagogical questions exist for the implementation of such courses: where to place such a course in overall curriculum, how best to model feedback, how to adjust pedagogy for client needs, and whether to teach tools through tutorial or immersion. One must also consider how to approach teaching serious game design principles while keeping lessons applicable within a larger curriculum. Likewise, there are questions of how to place clients in the overall course: how much influence they have on grading, how much contact they should have with students, and others based on survey data of students, clients, and other faculty.

TEACHING OUTCOMES AND METHODS

The course during which this research was performed, designated as GAME 232 – Mobile Game Development under George Mason's curriculum, began as one devoted to addressing growing demand for mobile game applications. In 2012, the NPD Group, a prominent game industry analyst firm, reported that mobile games represent twenty-two percent of the overall video games market, overtaking the "core" market of PC and console games. This is a nine percent jump from 2011[9] (Webster, 2013)—remarkable growth in a very short amount of time. Over several semesters, based on the demand of local non-profit and research organizations, the course also became one focused on the development of Serious Games for mobile devices. This section addresses the outcomes specific to the work done at George Mason, while framing them in the larger context of implementing client-based serious game projects in higher education classrooms.

Mobile Game-Friendly Industry Tools and Methodologies

As the topic of investigation involves the creation of games on mobile platforms, technical components of launching to these platforms are an integral part of the the teaching outcomes of the courses involved in the research. Likewise, the course's early placement in GMU's Game Design curriculum, currently listed at the second year level, requires that it involve software tutorials, as the students are encountering several tools for the first time. This allowed the investigation of how such courses could be placed in design curricula, as its second-year-level designation attracted a mix of students from second, third, and fourth years.

Engine considerations

Software tutorials were implemented in different ways in each semester to explore how to best approach software tutorials in project-based courses. The fall version of the course focused more on hands-on immersion learning than tutorials. It allowed students to guide their own path through the engine with their projects; for example, students working a tower defense-style game would have different learning requirements than another team making an endless-runner-style game. Ultimately, this method proved inefficient for helping students master the engine: although they had an entire semester rather than the half-semester the spring students had to create prototypes, fall students took much longer to reach the desired project goal.

For the spring semester, students had a choice of either Game Maker or Unity for their projects. As many of the students had used Game Maker in the past, the in-class tutorials focused on creating common game mechanics in Unity. Students worked with tutorials from one of the course textbooks, *Game Development for iOS with Unity3D* by Jeff W. Murray (Murray, 2013)[10], which teaches students how to implement Unity's pre-made mobile control rigs in playable games. The students also used custom tutorials prepared by the faculty that taught common game mechanics. While these tutorials were far from the center of the course, they had a positive effect on students' development efficiency in the latter half of the semester, which was devoted to the client project, and each group was able to create a complete prototype of their game.

When comparing the two methodologies for further adoption or exploration, it is suggested that instructors utilize a specific engine for the course with tutorials that explore mechanics that directly address client needs or project specifications. Depending on the target specifications of each project, tutorials may need to be structured to incorporate mechanics that will be required for the client's needs. In this case of GMU ACE, mechanics were a bit more specifically defined so tutorials were simpler to assemble. Keeping a tightly defined project goal among several groups rather than allowing a variety of game types helps teachers develop the knowledge needed to learn development engines.

Asset efficiency and modularity

Likewise, it was not only important to show students how to work with the chosen engine, but also how to implement games on mobile devices. In terms of art, mobile development requires a level of asset efficiency that other games do not. While other classes teach the creation of game assets in 3D programs, the technology used to build mobile apps requires different standards than are used on other platforms: students had to use less polygons and vertices than they could for PC and console games.

Likewise, it is common for many schools focused on game art or that contain a game art component to emphasize 3D art over 2D. Large-industry trends in AAA games support this: many popular games utilize state-of-the-art 3D graphics. Even mobile devices, which were once only capable of 2D graphics or simplistic 3D graphics, are becoming more sophisticated. Despite some of these trends, accelerated project schedules and a focus on building entire games instead of only art assets provides an opportunity in project-based courses for focusing on asset efficiency.

Due to the differences in time given for the client-based projects during the research semesters: the fall students were allowed the entire semester for the project while the spring students were given half of the semester; the type of art assets recommended by

faculty changed. In the fall, students were given the freedom to implement either 2D or 3D assets. Many student groups opted for a mix of 2D and 3D assets: 2D environmental objects or collectable items with 3D characters. However, student attitudes towards 3D art had not yet reached a point of maturity: the students doing 3D art would often spend an inordinate amount of time perfecting the asset rather than focusing on it as part of a larger project. In essence, they were "losing the forest for the trees." It was discovered that many students in the course were taking the introductory 3D art course, which is designated as GAME 231 in GMU's course catalog, at the same time as the mobile course. As such, they were eager to use their newly acquired 3D skills but lacked the ability to generate them quickly. This focus on 3D objects among some of the groups lessened the amount of time some of them had to work on their game.

Moving forward into the spring iteration of the course, students were told of the tight schedule and faculty members much more heavily moderated art asset production. Ultimately, students opted for 2D art in their games for their efficiency both on the devices and in production – they could better reach their project goals in the half-semester project portion of the course using 2D rather than 3D assets. Students found they still had a great deal of freedom in how they implemented their art assets: some digitally painted game objects, while others utilized pixel art techniques based on popular games such as *Knights of Pen and Paper* (Behold Studios, 2012)[11]. Students using pixel art were likewise able to implement animations and other special effects into their games. While not directly discouraged, faculty used the previous semester's difficulties with 3D art implementation to teach a lesson on project scope, detailing how art decisions should be made according to the schedule and goals for the project.

The differences between the two semesters reveal insight into the way art assets should be implemented in early encounters with game development. Art direction in earlier courses that involve full game development projects should be steered towards achievable goals: 2D line art, sprites, and simple 3D models. This allows students to focus more on the quality of gameplay and addressing client needs rather than developing realistic assets.

Mobile game design aesthetics

Courses focused on both educating students in developing for platforms and designing client projects present teachers with the challenge of balancing course content between design and software. In the previous section, software implementation concerns were explored from two approaches: one focused solely on exploratory training and another on more structured training with feedback. One challenge also present in the GMU implementation of such a project was the recentness of students' learning game design principles. Clearly, designing each game for the clients involved some exploration of mobile game aesthetics: engagement/interaction time, reward structures, etc. During the research, each semester differed from one another in how much material was overtly given to the students and how much was learned through immersion.

Case-by-case design lessons vs. lectures

In the fall semester of the GMU course, it was decided that game design principles for mobile games would be addressed in an open-ended fashion similar to how software lessons were approached. At the beginning of this semester, faculty and students studied some standard design mechanisms of mobile games, such as the "three-star" system popularized by *Angry Birds* (Rovio, 2009)[12] and others. During this semester, each group would meet with faculty and design issues would be addressed as needed so the groups could focus on completing the project. On one hand, this allowed each group to focus on

intensive study of their game's genre. On the other, lack of general game design knowledge actually impeded the development of several of the projects. In one such instance, students sent Century Council representatives a description of their game: players would control liver cells trying to hold off alcohol molecules invading the body after a night of hard drinking. The client objected to this narrative, citing that it implied that the person in whose body the game took place was already drunk. In this case, the students were advised that their game's mechanics, which they had developed after some considerable effort, could remain unchanged while the art and narrative elements of the game could be replaced. Having little understanding of how to separate the theme of a game from its mechanics, the students struggled for several weeks trying to divorce their game's theme from one that took place inside the bodies of the characters. After the course's conclusion, students approached faculty to say they had wished for more design theory content, citing that they would have liked to learn more about specific mobile games through analysis.

The following semester, faculty experimented with holding design lectures that ran parallel to the course's software tutorials for the Unity engine. In this case, design lessons on concepts such as core mechanics, games as systems, rewards, and others were taught in lectures and accompanied by play sessions of selected mobile games. Following the lectures with game sessions not only illustrated concepts in a concrete manner, but also taught students how to analyze games critically. Likewise, this focus on design thinking yielded better investigations of client needs during the project portion of the semester.

Problem analysis as game mechanics
These differing approaches to addressing design in each course created observable differences in how each group addressed their client's needs. Analyzing the games of each semester's classes showed that students with less analytic study of game design are likely to address design problems through emulation of existing popular products. Likewise, students with more analytic study of game design will take the time to dissect problems before entering into the design phase of a project.

The client for the fall semester, The Century Council, admittedly had a more entertainment-based goal – games had to contain the Council's rhetoric while still being something that children would want to play at home. As such, each group's design began with a mechanic popular on mobile devices: *Fruit Ninja*-style (Halfbrick Games, 2010)[13] swiping, "constant" running, tower defense, etc. Each group's implementation of the client's goals was simple: alcohol and other unhealthy items cause harm to the player while healthy items helped the player.

Students in the spring semester, on the other hand, had to create an app for guiding probationers through a complex probation methodology. In many ways, these students could not only pull from their experiences with entertainment games, but had to explore new genres in the serious games and gamification markets. Likewise, they had to pull these experiences into apps that focused on goal-setting and encouragement. Lastly, they had to explicitly avoid traditional game mechanics such as combat to address the possibility of the game being played by violent offenders. These restrictions yielded some very rich game experiences, including a game that embodied the probation process as a role-playing game in which players would earn rewards through real-world quests (such as enrolling in adult education classes) that help in in-game quests (such as retrieving items for a non-playable character) and an *Oregon Trail* (MECC, 1974)[14] style game where real-world progress allowed players to cross in-game rivers and mountains.

Overall, students that had a better knowledge of design felt confident enough in how to embody a real-world problem in a video game that they could ask the client question about their process, break down its systemic elements, then embody these elements in their game rules. Indeed, client representatives commented that the students had "taken a process that many need years to understand and made a game out of it in a semester."[15] Clearly, it was beneficial to students to take additional time to analyze games on the platform in question and learn how games can address real-world problems.

ENCOURAGING PROJECT/FEEDBACK CULTURES

In design schools of many types: architectural, art, graphic design, etc., there is a culture of project-based learning rather than one of tasks and solely grade-based feedback. As many of the students working on the projects during the research semesters had little experience with such courses, an obstacle for teachers was students' preconception of how they would be graded. For other project courses, they were given rubrics of tasks to complete with the understanding that completion of these tasks would result in a passing grade. To create a design-studio-like experience, faculty explained to students that their grade was based on their group's response to the client's design brief and their own contribution to the project. This model is the same used in many design fields for jury-based competitions where firms compete for a client contract, which each of these groups was doing: the best groups from each course would work with the client for another semester to have their app published and distributed for actual implementation.

Modeling a course based on a juried competition-based project is common throughout design education, and was therefore identified as a valuable goal for the research into client-based serious game projects. It is felt that such projects benefit greatly from cultures of collaboration, feedback, and iteration. For this reason, courses involved in the research followed a Constructivist model. This was done to evaluate how this affected students' focus on projects rather than rubrics, their collaboration within teams, and the development of collective knowledge between teams.

Constructivist learning

The basis for many project-based courses in design schools is the Constructivist teaching model. Constructivist teaching has origins in the interaction-based Montessori Method, in which teaching occurs as information is absorbed by sensory-based interaction and interpreted by the intellect (Bogost 2007)[16]. Other early influences such as David Kolb advocated for combining this kind of activity-based learning with reinforced feedback from a teacher or critic (Kolb, 1984)[17].

Constructivism is used as a model for modern adult education, design, and art schools. Schools of Architecture commonly have "Studio" courses where students are given a set of project guidelines for a building: building site, client, square footage, building use, etc; and are asked to design a building that fits the stated brief. During such courses, teachers; often called "critics"; oversee the project and give feedback without direct intervention. Likewise, there are regular project critiques where the student must publicly present their project to the class, their critic, and outside evaluators of the course of a semester in an exhibition reminiscent of meetings with clients. These critiques are designed to help the students guide their project towards a final product that appropriately fits the goals of the design brief.

This model was adopted due to its conduciveness to client projects: it represents a close simulation of a design-studio model within the classroom. Faculty experimented with the

frequency of client feedback to gauge how much would be appropriate to such courses. The fall semester featured less, while the spring semester featured a weekly visit by clients. Surveys taken after each iteration of the course demonstrated that students preferred a greater amount of client engagement and feedback. This showed that there was value in iterative project management processes for such courses.

Focus on Projects
When utilizing sessions of client feedback for guidance, such courses resemble the Constructivist methodology laid out by Kolb and colleague Roger Fry. In their work, they outline four stages of iterative development that are repeated by a student: concrete experience, observation and reflection, forming abstract concepts, and testing in new situations (Kolb and Fry, 1975).[18] In a typical design class, students engaging in this model gain concrete experience through designing and building models of their project. They then get feedback from a critic or group of critics: this allows the student to observe reactions to their design and reflect on issues with it. They then research new ways in which to approach the design problem (forming abstract concepts) and form a plan for new enhancements to their design (testing in new situations.)

In the practice of the George Mason Mobile Game Design class, this methodology had students receiving their design brief from their clients, and then creating a game design proposal for client review. At each stage the students received feedback, learned how their designs could be improved, changed the design for the game, and then implemented changes. This model follows iterative design processes advocated by designers such as Tracy Fullerton[19]. As stated previously, research showed that students valued more client feedback and therefore, more opportunities for iteration. The later semester's version of the course, where many of the projects better fulfilled the clients' needs, had more opportunities for client feedback.

Team-based collaboration
Another important element of Constructivist-based design courses is having students work in a team structure. This is especially important in game development, as the tasks required to construct a game; art asset creation, gameplay programming, sound design/asset creation, level and environment design, etc.; can be difficult for a single person to accomplish. Beyond questions of deliverables, however, regular collaborative work for students helps build other "soft skills" important to future projects.

Engaging in team projects greatly helps the development of team management and communication skills (Totten, 2010)[20]. Even in design environments that are not explicitly team oriented, such as posting for help with a game project on an internet forum, communication is a large part of ensuring that problems are solved quickly. Likewise, designers of different backgrounds often have different methods of communication. As such, practice with these differences as students help people solve them later on as professionals.

Striking the right balance for team size was important. Both semesters utilized teams of five students each as the typical team size, but there were also instances of six-person teams. Feedback gathered after both semesters showed an interest in smaller team sizes, citing that it was easier to keep smaller groups consistently busy than larger groups.

Social collaboration between teams

Another important element of the Constructivist model is not only the collaboration between members of individual teams, but also the collaboration between members of different teams. In many Constructivist models, social learning between a large group is effective for developing a shared knowledge among learners rather than a collection of individual instances of information (Duffy and Jonassen, 1992)[21].

In the Mobile design course, students began the project as discrete groups that rarely shared information. Eventually, however, common themes became apparent between teams. During the Fall semester, during which the client was the Century Council, students shared information on using the Unity game engine and began using similar game mechanics in some cases: alcohol as an item that negatively effects players, etc. Even more explicit, however, was the development of the spring semester students, who were creating games for ACE. These students began using class presentations to the client as opportunities for gathering information on client goals not only for their own group, but also for other groups. Over time, the students all gained a thorough understanding of the design brief for the course.

Indeed, client-based feedback events became an integral part of the course in both semesters. Not only were they valuable to both client and student, they also helped establish a culture that could have benefits into the future of the program. This points to the effectiveness of this structure for fostering class-wide collaborations. This is something that can easily translate into other courses: having students be masters of specific information then sample the results of one another's presentations to build collective knowledge and presentation savvy.

Presentation-based milestones and studio culture

In real-world game studios, milestones are an important part of enforcing deadlines and production schedules. Publishers set milestones that developers must meet so they can be paid. Likewise, event-based milestones, set dates for finishing playable demos or trailers to show at game conferences or press events, are also set. On a more academic level, important presentations or meetings with clients (if a class utilizes them) can serve a very similar purpose as these industry events.

On the practical end of course development, event-based milestones give teachers of design-based courses gradable material. Each presentation can be given a rubric based on project goals for understanding the technology, game concepts, and client needs. Likewise, having presentations prepares students for in-office presentations and meetings that they will have to discuss art or game development issues.

In terms of building a presentation/feedback-based culture in game design schools, the expectation of presentations combined with a collaborative learning atmosphere can help create a self-reinforcing studio culture within classrooms. This type of classroom studio culture is often found in design schools. In these schools, students work in a collaborative space and can view not only their own projects, but also the projects of their peers as they work. Likewise, they can visit and discuss the projects with one another. In the right architectural space, this can even extend to students of different levels so first and second year students can meet and talk with students in third and fourth year students, or even graduates. These scenarios help students build a mental road map of the design courses they can expect to take that not only exists on a curriculum form, but also through the work of each other. Likewise, exposure to one another's work and a shared social

knowledge base can allow students to rate one another's work in an informal fashion or offer help.

Courses such as the client-based design project of George Mason's Mobile Game Design course have a lot to teach not only students, but also educators about how game development courses can be structured. In the next section, recommendations for implementing such courses will be discussed.

RECOMMENDATIONS FOR WIDESPREAD APPLICATION

Overall, a client-based design studio with a Serious Games focus has been a success. Surveys have shown that over 60% of students are enthusiastic about the format, with many celebrating the group work, client-based project format, and how the class allows them to experience realities of real-world game development. Majorities of students (70% in the fall and 86.4% in the Spring) have also reported having a positive outlook on their projects, citing that they are excited to more integrate these projects into their portfolios than typical entertainment games (Totten, 2013)[22]. Likewise, clients have been enthusiastic about the outcomes of each semester's projects and are looking forward to implementing their apps into their programs.

From a curricular standpoint, the course – as implemented in the 2012-2013 academic year – has allowed faculty to investigate where such a course should be placed in a curriculum and how it should be implemented.

Course structure

Perhaps the largest amount of negative feedback for the course came from questions regarding its structure. In terms of the specific GMU course, it was requested that the course not be offered at the second year-level, but be reserved for more advanced students. Likewise, groups or class sections that saw more success in terms of project completeness and satisfaction of the client were comprised of third and fourth year students (Totten, 2012 and 2013.)

From the outcomes of each course, it was apparent that the structure from the Spring semester: half a semester for tech tutorials and design theory with the second half reserved for the client project; was the more successful. However, accomplishing three diverse learning goals: teaching design, teaching mobile game engine technology, and creating a game for a client; was a daunting task for one semester. As such, it is recommended that educators seeking to implement similar courses consider breaking the George Mason model into two semesters: one focused on the design of Serious Games and small projects to introduce an engine and a second devoted entirely to a client project. If such courses are implemented in other schools, it is likewise recommended that they be implemented at higher undergraduate levels, perhaps as a capstone course in fourth year, or as the theme of graduate courses. Rapid iterative game development requires a great deal of expertise in software tools. While students still greatly expanded their own skill sets through both research semesters at GMU, the faculty felt that more could be accomplished with more experienced students.

Class theme

Industry trends also call courses with mobile technology as a theme into question. Increasingly, mobile games are becoming a platform equal to personal computers (PC) and television-based game consoles rather than havens for "casual games" or "shovelware." Increasingly, industry events that formerly treated mobile gaming as a

special category, such as the Independent Games Festival (IGF) are treating them as a platform like any other. Indeed, one pitfall of game design education highlighted at the 2013 Game Developers Conference (GDC) Education Summit was focusing too closely on specific technology within game design curricula (Flanagan, Fullerton, Hall, Wardrip-Fruin, and Zimmerman, 2013)[23].

Due to the developing position of mobile devices in the industry, it is recommended that educators seeking to implement such courses explore adding mobile development to their existing courses rather than making special courses for them. On one hand, mobile devices are appealing platforms for teaching students the realities of publishing. These platforms are accessible and at the time of this publishing do not allow for careless use of art assets or inefficient code. On another, treating them as one would a PC or other device allows flexibility for migrating towards other devices that have yet to be released.

Diminishing the role of mobile devices in client-based serious game courses also allows for a greater diversity of clients to approach schools. For example, a client could want a university to develop a serious game web application or PC title rather than a mobile device. In this way, the course becomes about serious game development entirely and less about specific technologies. Such a course could even be implemented as a requirement during students' fourth years as part of a "capstone" process.

Class content

Lastly, it is important to explore how to best prepare students for these courses. As has been shown, the Spring version of the course, which featured significantly more exploration of game design and engine tutorial content, was more successful at achieving course outcomes. As stated previously, it is recommended that courses similar to those undertaken at GMU be divided into two courses: one on Serious Game design theory and the technology used for building them on several platforms and a second devoted to a client project.

In the GMU curriculum, students take the mobile class at or near the same time as their introductory course to game design theory. Likewise, they have not had a great deal of experience with Unity or any other engine. This requires the mobile course to overload the content necessary for achieving the class goal. In colleges that can support the two-class structure within their curriculum, students should encounter the Serious Game design course during their second or third years, with emphasis on how Serious Game design correlates with game design theories learned in other courses. Likewise, client-based projects should be undertaken during fourth year when the student has had adequate practice with a variety of game tools: engines, asset creators, etc.

CONCLUSION/FUTURE WORK

As has been shown, client-based Serious Game project courses can add a great deal to the education of young game designers. They offer alternatives to typical entertainment-based games that are typically utilized in schools and demonstrate the breadth of the industry to students who will be seeking employment in it. Likewise, they offer real-world outcomes beyond simply making a game "fun." Engaging these game projects in collaborative group environments with several teams working near one another can likewise enhance the development of students' design abilities: both in their ability to analyze a design problem and in their skill as they compare work with others.

Future explorations of such class structures will engage more traditional, lecture-based game design courses such as the History of Game Design to discover how projects can aid in the absorption of content. Using the "flipped classroom" model, where lecture content is delivered online and class time is used for activities[24], students can explore academic game design content through hands-on investigation in game projects.

ENDNOTES

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