Student-lead, Interdisciplinary Project-based Learning for Continuous Success in Animation Education

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ABSTRACT

In the animation industry, as with many other industries, there is a demand for not only skilled artisans but also creative thinkers, problem solvers, leaders, and communicators. As a very small animation program at Brigham Young University (BYU) competing against large programs at art schools, we have to play to our strengths as a program and university. This incorporates interdisciplinary, collaborative mentored experiences to help students develop both specific skills and well-rounded success. They bring their creativity into a structure where they can not only learn skills but also be empowered in their work and learning. Our students have had major success in winning awards and with high hiring percentages including top studios. This paper outlines some of our methods for helping these mentored experiences thrive.

Keywords: Interdisciplinary education, Collaboration, Student Leadership.

1. INTRODUCTION

The animation program at Brigham Young University is a small undergraduate program, only able to take in 25 students a year into the animation major and 12 students a year into the Computer Science (CS) Animation Emphasis, with only a handful of faculty; yet it has garnered consistent success with awards and placement in the industry. It has won 18 College Television Awards, or "Student Emmys", in the past 13 years. In the 5 years we have taught games, we have been accepted to E3's College Competition 3 times, against top graduate schools. Our program regularly places students at top film and game studios such as Pixar, Blue Sky, and Blizzard. There is enough external interest that we were featured in a New York Times article. Studios laud the interdisciplinary set of skills that individual students demonstrate straight out of school.

How does a tiny program garner so much success, even early in the education process? How are we able to fill industry needs so quickly? The core of our success comes from a highly collaborative and interdisciplinary program culminating in a year-long, student-led Senior film project. The program consists of an Animation major, in the fine arts college, and a Computer Science Animation emphasis, in the college of math and physics. The small number of faculty cover 4 departments - Illustration, Computer Science, Film, and Design - a broad collaboration of disciplines for a single program.

The Senior projects combine active learning, leadership, and interdisciplinary opportunities. Every year, the seniors experience student-guided learning by working together to drive the production of two large group project, either an animated short or a video game, across two university colleges. The students are responsible for the entire production, which empowers them as they take charge of their own learning. They fill leadership roles, such as director and producer, come up with the story or gameplay, run the pipeline, and set expectations. Computer science, art, illustration, and music students work side by side to solve problems to achieve the look and story that they develop. Ultimately, they are responsible for their own ultimate success or failure. The faculty stand on the sidelines, yet still wholly available as mentors, a "brain trust" that provides experienced feedback and guidance in each of their areas of strength. There is no spoon feeding. This whole setup lets students learn from their own failures and more from their successes, while leading and organizing. Each student knows they have to carry their weight in the collaborative process. Experience comes as students tackle the additional problems that come from working in a larger project environment with high collaboration yet limited safety nets. While students gain depth of experience in specific areas of focus, they also learn broad concepts due to their need to work and communicate with peers in various disciplines.

This paper describes how our student-led, interdisciplinary group-based learning method projects students to success. This includes lessons learned; what techniques have worked and what has not; how to help everyone participate, both students and faculty; and how we resolve conflicts.

2. LIMITS

Our search for a less routine educational process started with an honest evaluation of our limits. As David could not use a conventional approach to counter a Goliath, we had to look at what limits we had to overcome to give students an opportunity at making a difference in the animation and video game industry.

Here are some of those limitations we encountered as a university trying to do animation:

1) University curriculum. BYU is a university, so students have to pass English, science, and other general education classes, giving them less time to focus on animation than at

an art school. Because we are a university, we can only require 25 art classes. Typical art programs are around 40 art classes to get a BFA. Students also have to get accepted into BYU before they can apply for our animation program. Students accepted into BYU have an average 3.8 GPA and 28 ACT score.

2) Limited size/resources (animation is expensive!). A full length Pixar film can cost $1.5-$2 million per *minute*. A short animated film can have a production cost over $1 million. Most of the cost is man-hours, meaning that animation requires much time and effort to achieve professional, demo reel quality.
3) Animation = Team Sport. This difficulty is that education tends to be an "individual sport", both for students and faculty. Even when group projects are encouraged, they tend to be 2-3 people.
4) Multidiscipline requires extra administrative time. We coordinate meetings and paperwork for our majors, department, inter-department, inter-college, and umbrella Center for Animation.
5) Need to be a "Da Vinci". The field of animation require expertise in multiple skills, both "technical" and "artistic".

Another major limit is the weaknesses and missing skills of graduates going into the industry. We looked at a 1990 study by a BYU faculty team [1] to evaluate and address these weaknesses, some of which include:

1) Lack of design capability and/or creativity
2) Lack of appreciation for variation
3) Poor perception of the overall production process
4) Narrow view of sub-disciplines and how they fit into the larger pipeline
5) No understanding of iterative quality process
6) Taught to work as individuals
7) Lack of initiative, ability to self-teach

In other words, they are often over-guided and lack a bigger picture experience.

How can a student learn to collaborate in education, which often focuses on individuals? How can they reach the depth and breadth of experience?

3. MULTI-DISCIPLINARY PROGRAMS

To succeed, despite our limits, at providing the breadth and variety of experience needed for students, we combine university resources and collaborate between multiple departments and colleges.

A full animation production requires a broad spectrum of skills that encompasses art, narrative, and technical ability simultaneously.

Purpose for a multi-disciplinary program

In our program, animation started out in the Art college, but it became apparent we were getting very bright artists. The technology of animation was changing rapidly as well. With the high technical backgrounds of our art students, due to the nature of BYU's acceptance process, the "both sides of the brain" nature of computer animation and demand for technological background fit well with our strengths. We realized we could and should cover both technical and artistic areas of our discipline.

This was to our advantage, the changing technologies matching the change in the type of students that we were getting into the program. On the other hand, computer technology was expensive and had little in common with "more traditional" fields of an art department. There was little overlap in equipment needs with the other programs. Yet we still had to teach all of this new technology to the students as well as catch them up with their drawing skills with limited faculty resources. Plus, there was another element to deal with. The same issue of high student demand on entrance into BYU had pressured the university administration to take a hard look at how long it takes to students to graduate. The quicker a student graduates, the sooner another student can be admitted to the university. While we were looking at integrating these new technologies into coursework, the university was putting tighter constraints on how long it takes a student to graduate.

After evaluating our strengths and industry opportunity, our early Animation program realized there was similarity with programs in the Engineering college. After much study and conversation between departments, we ultimately straddled the Fine Arts College and the Engineering College. We knew it would be extra paperwork, but it gave us access to technology and support of the arts. Then, Computer Science students also got involved in early projects and it was clear that there needed to be a solidified collaboration of disciplines to maximize the synergy of skills and resources.

Computer Science and the university admins were excited about the early successes and prospects, so much they officialized it into a multiple disciplinary Computer Science Animation emphasis, that its curriculum required participation with Animation's classes and capstones. It was a risk, but within the first years it saw a raise in quality on large projects, more efficiency of the pipeline (shortened large projects from a year and a half to a year), and increased industry interest in the program.

With educational systems tending to reward individuals, for both students and faculty, coordinating between departments means extra work. But it is possible. Coordinating faculty schedules, administrative curriculum, computer systems, and budgets was a risk that paid off for us in a major way.

Our current program

So in the end, we have an Animation major functioned by our Center for Animation, which is served by 7 faculty spread over 4 departments (Computer Science, Design, Media Arts, and Illustration) within 2 colleges (Fine Arts and Physical & Mathematical Sciences).

Additional to our Animation major, we have an animation emphasis in our Computer Science program. This has caught high praise and attention from top industry companies such as Pixar.

As previously stated, this requires major overhead. Not everyone at the university will appreciate the amount of resources going into a small program when they can be distributed elsewhere. So how did we do it?

We achieve a multi-disciplinary atmosphere by:

1) We keep the program small with high success percentages.

2) Support from the university leadership and the board, based on our hard work and success. In order to protect our program and ensure resources, the university created a Center for Animation to house the program and provide a central point where all the faculty and departments involved in the Animation program to come together.

Again, we are able to thrive because the successful results are consistent. Is the extra overhead of inter-disciplines worth it? We have to look at our goal, and the fact that it brought us closer to our goal. This lays the foundation for the educational experience that will more fully help students – A collaborative, mentored experience.

4. COLLABORATIVE EXPERIENCES

Creativity in media is a collaborative effort. In our program, we are specifically focused on animated productions, visual effects, and video games. Our students are hired out to all three industries.

Large group projects
The way we teach collaboration and the various skills that come with it – leadership, communication, perspective, quality, creative problem solving – is by creating group project experiences as a capstone project. It lasts a year. We base it off full production.

When we say large group projects, we are not just talking about groups of 2-3 people. Our projects involve anywhere from 20-40 students, which consists of our Senior class in both Animation and CS and often some Juniors. It requires consistent vigilance in communication and coordination and teamwork.

The students are in charge of and run the whole project.

Why group projects?
The critical output of education for our students are 1) portfolios to demonstrate their skill, and 2) "soft" life skills, which provides great interviewing potential for jobs as well. Group projects allow students to specialize in their desired emphases within the pipeline, while generalizing in broader contextual skills in order to fit into the process. Projects go deeper with specialization (polish, high quality), give leadership opportunities, are motivated by the group, imbue more general interdisciplinary skills, and teach communication. This is what the industry needs.

Process
For both the short animated film project and the video game project, students start out by pitching out several ideas to the team. The team votes on their favorite, then they all take ownership of the winning idea. We feel it is an important skill for them to take an idea, whether or not it is their own, and make it better because they were a part of it.

After choosing an idea, the broad production schedule is set up. Students vote on a student director and a student producer guide to guide the process and deadlines.

We often choose a festival that students can aim to submit to in order to help motivate them and their final deadline.

Roles
Students fill all the project roles. Leadership often means more meetings for the students who take on roles, yet with the same addition workload required of everyone else on the team to create demo-reel worthy work. Nevertheless, it is invaluable to their development of lifetime skills.

We define the following roles, where students either volunteer themselves or vote from their peers.

1) Director. The director decides the vision of the story or game very early on, and makes sure the project retains that vision in making decisions and directing others' work. The director is often the first on the project and the last to leave.
2) Producer. The producer is the heart of the motivation of the projects. They help teammates make and keep deadlines, holding them responsible in front of their team. The motivator should be positive. On a recent film project about a young monk, the producer would ring a small gong whenever someone completed a deadline, much to everyone's enjoyment, as it was both satisfying and something of an inside joke. The producer would also arrange team activities outside the lab to promote comradery.
3) Technical Lead. The tech lead helps build and drive the team responsible for the pipeline and technical problem solving. They are the forerunner of problem solving when there are no immediate answers, not the faculty. We do not hand hold.
4) Other leads: From there, students can lead smaller groups (e.g. Animation Lead, Lighting Lead, Game Prototyping Lead, Characters Lead) as required or gives them opportunity.

Difficulties
It makes sense to give a collaborative experience to students, to prepare them for collaborative arts, but we need to make sure it teaches the right skills. As with creating interdisciplinary programs, collaboration in education is not always trivial:

1) Education is individual sport.
2) Group projects mean more effort by faculty behind the scenes.
3) People fear how students will play.
4) Roles are unclear.
5) Portfolio evaluation is trickier, as students' individual work still needs to stand out from others'.
6) Student have conflicts.
7) Empowered students could take things the wrong direction.
8) If individuals do not pull off their part, the whole group could fail.

How to succeed with groups
It is important to aim to empower students and help them work well and hard, owning their creative output and fitting together with others' work. Here are a few strategies that help achieve those goals:

1) Workloads need to be fair and consistent. One of the most difficult challenges unique to group assignments is ensuring that workloads are fair and consistent. Different roles start and end at different times. Make sure that the roles stay flexible so that when one area starts to demand larger amounts of work, that others can step in to help. Bottlenecks can kill group projects faster than anything else. If several

students are sitting around idle because they are waiting for other students to finish their part, or because the workflow has not been thoroughly worked out, the project will quickly lose momentum. It may not be possible to recover from this problem. With the help of the producer, make sure that goals are established and that checkpoints are reviewed constantly. We try to anticipate bottlenecks, and often get students who are idle onto the bottleneck area, even if it is not their area of expertise, which leads to broader experience for them.

2) Evaluation methods should encourage students to try hard things. On these projects, students' competency matters more than their grade. They know they cannot just slide along and have success. Students are also encouraged, and feel more willing, to try new things because they are not simply chasing after a grade.
3) Students should come up with the project idea. This is their project, and they will feel more ownership if the idea comes from somebody in the group and they had a say in what was chosen.
4) Reward students for doing the smaller jobs. Students need to be able to do grand things and small things, as in the real world. This is the glue that is the difference between a bunch of individual pieces and a bunch of pieces that work together to make a prosperous project. We watch those who do both large and small, unglorious jobs have the easiest time getting hired.
5) Let students set and hold deadlines. When students own their projects, they even come up with their own deadlines. If they have the drive to meet these deadlines instead of deadlines from someone out of the loop, they are more invested. We had a student on our current film project make detailed spreadsheets that students were excited about, much better than if faculty were setting that. When students are empowered, they hold each other accountable.
6) Stick with a direction. Once students find a story or game idea, we hold them to it. Ideas always need iteration, but we have found they can make any good start better and successful. Otherwise, students get bored of last week's ideas, a completely new story or game idea shows up each week, and the project gets nowhere fast.
7) Provide leadership opportunities. One goal is to always give students leadership opportunities. This could be the key part of the group project, because they will have more positive influence in future jobs. We set up roles in the group that allows as much leadership training as possible. We even set up multiple roles for each student. At various times, students will either be leading a group or being led, both experiences leading to maturity.
8) Make sure students have roles, but faculty should not assign them. If they assign the role, then when the work gets hard, we see them get blamed for every problem. Spend time with each student allowing them to decide what they want to get out of school, the project, or even life. Help them to understand potential roles that they could play. There are roles in the group that you might not want a student to fill. Oft-times in a project there is work that needs to be done, but that won't create any new skill or knowledge that you care for a student to learn. Try to get funds to hire someone to do that part of the project or find someone already hired to do it.
9) There is always a concern by industry that they might not be able to evaluate a portfolio from any individual student when the project was done as a collaboration of students. "How do I know what you can do if everyone had their hand in the making?" The students will need to accurately show what they accomplished and what they have learned. The creation of well-defined tasks, roles, titles and so forth helps this. If students give you a copy of their portfolio upon graduation, you can track who is claiming what. The industry also knows of and supports us in this which, while once a concern, has never been a real issue.
10) Do not run the project exactly like a studio. Industry methods guide a lot of the way our projects run, but there is a critical difference between us and industry. In education, our main product is the student's portfolio and character, not the film or game itself. The project is just an extremely valuable means to get them jobs and skills.

A lot of these guidelines depend on students taking the lead, begging the question, what do faculty do?

4. MENTORED EXPERIENCES

Even with students leading and determining the content, our program does not leave faculty or other mentors out of the equation.

Students bring in a great amount of creativity, but in our experience, that creativity needs to be guided like a river, otherwise it becomes an uncontrolled flood. In many instances, students like to give out ideas but find more difficulty sticking to one idea before other ones become more exciting. With each round of feedback, they often start over from scratch instead of addressing specific issues.

Mentors can provide high-level guidance when things start veering in the wrong direction and specific advice to get them up to speed with important principles and latest techniques.

With mentoring, we retain a "thin safety net", where we do not hand hold students or try to fix things every time students run into a problem. We do not expect mentors to know all the answers. This preserves student empowerment, where they get opportunities to solve fresh problems, implement their own ideas, seek help in forums, and so forth.

Faculty mentors

If someone were to visit a BYU animation or video game project's dailies, which we hold in a screening room, they can expect to find students sitting at the front, leading the reviews and discussion, with faculty sitting in the back.

We faculty often work as a "brain trust" and as executive producers. This means we can watch how students are doing and provide counsel. As executive producers, we also have a right to veto ideas or directions if we see that it will have a negative impact on other students or the project as a whole. We take the instructor role and mentor with students individually when we see individual needs. We have discussions with leadership to see where things are, make suggestions, and take questions. We hold them to a high standard, so that the focus stays on polishing their work and not falling into complacency.

For example, when a team shows off character designs and needs to choose which direction to go, a faculty member will speak up as to things they should look for in good character design, but then let them make the decisions from there.

Another way faculty help is by mediating conflicts between students, adding on top of a normal faculty workload but giving students the experience and ability to work together that they need. We sometimes joke that we are "marriage counselors" between the director and producer, since one is going for the perfect story, design, or artistic look, while the other is aiming to hit deadlines. But this is real life, and our consultation helps them learn consideration of others and balance in decision making.

Industry mentors
Mentoring studios include Pixar, Blizzard, Blue Sky, DreamWorks, and MPC, among others.

BYU alumni in the industry often want to give back, and our students are fortunate to have them as mentors. Feedback from industry professionals is invaluable – they provide the most current techniques and skillful feedback. We have found, however, that too much feedback from even industry artisans can lead to confusion or overwhelming desires by students to chase every direction.

When given their time, we *do* want studios to spend time with students as much as possible. A typical visit from a studio is as follows: They meet with faculty to get up to speed on what is going on in the program. Each group project shows off current progress, describing techniques and process to get there, then giving time for feedback. Then visitors are encouraged to give a "making of" presentation about current work from their studio, to give students a super valuable, bigger picture of how things work in production. Finally, and possibly most importantly, the studio mentors will interview students individually or sit down with them in the student lab to mentor them directly on their work.

When studios leave, students take charge to find patterns in feedback and prioritize notes from the visit. They cannot chase every idea and also finish their work, but the notes they are able to address make a world of difference.

With each studio, we do not need more than one discussions a semester or even a year. We find that if students spend too much time with studios, they get pulled too many directions or do not have enough time to be working themselves.

Students lose their empowerment if we mentors step in too often.

5. EXAMPLE PROJECTS

Short animated film projects
Our first large-scale film project was "Lemmings" in 2003. It is a 5-minute story about a lemming trying to stop his fellow lemmings from the inevitable. It started with a few lemmings, but lemmings being lemmings, Brent Adams advised that it made more sense to have a thousand lemmings. With so many people on the film, the film could still get made while a small team dedicated months to generate a crowd simulation system to automate the animation of many lemmings, knock them over like dominoes, and write a tool to add fur to all of them. The resulting quality was high, both in look and in technical difficulty, especially coming out of small university undergraduate program. It was a success. It won a College Television Award ("Student Emmy") and a Student Academy. The students got great internships and jobs in the industry, helped by the fact that they got to spend time diving deeper into interesting story details.

The 2004 class' project was "Petshop", another 5-minute film. The question that came up was whether "Lemmings" was a fluke, or if the success would repeat. Was this collaborative experience helping only one particularly talented group? On "Petshop", students worked like crazy and took charge of giving their animation a good story and a painterly look, solving hard problems where nobody on the team or faculty had answers until students dug deeper. "Petshop" won a College Television Award and opened doors to studios like Pixar.

The success continued with a film project each year. Students still earn opportunities getting into the field, getting good paying jobs in an area they love and built characters.

We still implement yearly short animated film projects. Older projects took a year and a half to complete, now they only take one year. Faculty and students have learned and progressed over the years, some of the lessons learned listed above.

Video game projects
A bigger test of our collaborative, mentored group projects came a few years ago. We found that every year there was a group of animation and computer science students who wanted to do video games. We had alumni in the industry who expressed wishes there was such a project when they were in college. Even more importantly, studios in the video game industry were interested in our students but increasingly expressed the need for graduates to have skills specifically applied to video games, not just film.

We evaluated needs and realize there is still enough overlap of skills with animated film that it's possible for students coming out of our foundational courses to enter either an animated film or video game project, according to their choice, and have success. Our animated film projects were established enough that splitting some of the students into another large group project did not hurt its success.

The question was, could our large group project process succeed with the video game projects?

Even without an increase in resources or students to the program, we decided to start a yearly group video game project, running in parallel with the film project. We started with a smaller group of 8 students, in 2013, on a game called "Witch Hunt". Following our student-led, collaborative process, students had a successful run. They submitted a game to the E3 College Game Competition, at a top national video game expo, and were accepted as a top-5 finalist against many top game programs.

Once again, we asked if this was a fluke. On our 2015 project, "Relic Hunter", our group of around 20 students were accepted at E3, then once again in 2017. We have students from projects getting accepted at companies such as Microsoft HoloLens and Blizzard.

6. RESULTS

By collaborating multiple disciplines and letting students lead on group projects, we were not only able to raise our program up to a competitive quality but more importantly give opportunities to students from a small program to get into a small industry.

We have a consistent number of College Television Awards and Academy Awards. The latest College Television Award came this year, with a BAFTA award last year. The current game project won our third E3 nomination.

Ed Catmull, president of Pixar, gave the following quote a few years ago: “It's amazing to suddenly see that BYU is producing the best in the industry,” … “It's the perception not just at Pixar but also at the other studios that something pretty remarkable is happening here.”

7. CONCLUSIONS

In conclusion, we have learned from successful experience that combining disciplines into collaborative projects and giving students charge can empower these students, foster their creativity, and accelerate their progress to achieve their goals.

9. REFERENCES

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