Addressing cross-disciplinary graduate-level learning goals through game design

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ABSTRACT

With the rapid growth in online MBA programs, many traditional schools are seeking ways to differentiate their course offerings to avoid them becoming commoditized by the market. For some institutions this involves pulling away from traditional course offerings, and moving towards cross-disciplinary offerings. For many faculty members, this can be a difficult venture and often relies upon team-teaching and new attempts at integrating a broad set of ideas into a cohesive course. At the same time, faculty teaching these courses are concerned about the best ways to engage the students and keep them motivated throughout the semester.

This paper outlines one such example of how cross-disciplinary goals and a motivational learning environment can be integrated in a way that is both challenging and rewarding to the students. Using the ARCS model of motivational design, the course was evaluated as an educational tool.

Keywords: engaged learning, game design, game play, ARCS, student motivation

INTRODUCTION: ENGAGED LEARNING AND MOTIVATION

"Tell me, I'll forget. Show me, I'll remember. Involve me, I'll understand." This frequently quoted Chinese proverb is as applicable in today's educational environment as it was 2000 years ago and can even be used to define what today's educators call "engaged learning". There is little doubt that learners of all ages learn best when they are intimately involved and "engaged" in the subject matter, and there is no shortage of research supporting the theory that people learn, remember, and understand material better when they are able to apply what they've researched and discussed to solve real-world problems. When students immerse themselves in creating solutions to problems, it gives them ownership of their learning and motivates them to not only continue to learn, but also to develop a deeper understanding of the application of what they have learned.

However, tapping into each student's motivation to learn, understand, and apply material can be a daunting, and sometimes unattainable, task even though it is central to the goals of every educational institution today. As noted by John Keller), who created the ARCS Model of Motivational Design, many teachers believe that motivation is unique to each student and is, therefore, something that is out of their control. As a result, they focus on their teaching and not on the students' motivation to learn. This is a mistake, however, because as Keller claims, "…we know that no matter how motivated learners are when they begin a course, it is not too difficult to bore them, if not kill their interest totally." Thus, it is imperative that teachers figure out ways to maintain student motivation throughout the course. (Keller, 1987)

THE ARCS MODEL OF MOTIVATIONAL DESIGN

Keller questioned whether a practical model could be created that would integrate all of the research on student motivation and could be used by educators in the classroom. As a result, he developed the ARCS Model—"…a method for improving the motivational appeal of instructional materials." (Keller, 1987) The ARCS Model consists of four classifications—Attention, Relevance, Confidence, and Satisfaction as described by Francom (2010):

- Attention: Directing and sustaining learners' attention to appropriate learning materials
- Relevance: The perception of the relevance of the learning materials to the learners
- Confidence: The level of confidence that the learner has that he or she will succeed
- Satisfaction: The level of the learner's satisfaction felt from their accomplishments

OWNERSHIP AS MOTIVATION

Keller's model focuses on creating instructional materials that motivate and challenge each individual student to learn. It is an intrinsic motivation for each one. What is not specifically included in his model, however, is the concept of "ownership". When students are asked to analyze situations and/or solve real-world problems, they are more likely to feel some ownership and, therefore, be intrinsically motivated to do the work required to thoroughly analyze a situation and/or solve the problem.

Providing students with situations and problems that they deem worthy of solving is a different type of ownership than the ownership that normally arises in the typical classroom. In most classes, students view assignments simply as tasks to be completed in order to pass the class. They do not feel any personal connection to the assignment and, therefore, no ownership

and no motivation to learn from the exercise. If, however, the teacher can provide assignments that allow the students to feel some personal connection and ownership of the situation or problem, the students will be motivated to do well and learn from their work. One way to provide that personal connection is through game play. "You know that students often develop personal interest in (ownership of) the problem of playing a game well." (Moursund, 2006) They want to win. "One of the reasons why a game can be a good learning environment is that the game player is immersed in the environment (the situation) of the game. The attention grabbing and attention holding characteristics tend to shut out distractions." (Moursund, 2006)

GAME-PLAY AND GAME DESIGN AS MOTIVATION

Using games for learning has been popular in the K-12 arena for decades, with teachers and parents using Chess, Scrabble, Checkers, Monopoly, Risk, etc. to teach everything from spelling to strategy. Over the past 30 years, these board games have been nearly supplanted by videogames like Lemonade Stand, Oregon Trail, MathBlaster, and SimCity, and today, the majority of game-based learning relies on digital games as opposed to board games. Nonetheless, the benefits of using games as learning tools is continually being supported by research. In a 2005 research study conducted and reported by Richard Blunt, students in a class in which video game-play was used "…scored significantly higher means than classes that did not." (Blunt, 2007) Furthermore, "…game players regularly exhibit persistence, risk-taking, attention to detail and problem solving skills." (Klopfer, et al, 2010).

Likewise, game design can be as beneficial as game-play in the learning environment since it requires students to thoroughly understand the material and relate it to the game-player in a comprehensible fashion. "Because a designer must be knowledgeable about the system he or she is designing, using game design in this way requires students to think through how their players are learning and what they need to know about the subject of the game. In this way, students not only research material to be used but also edit this material and are introduced to issues around credibility and point of view." (Klopfer, et al, 2010)

APPLYING THE ARCS MODEL, OWNERSHIP, AND GAME DESIGN FOR CROSS-DISCIPLINARY LEARNING

Taking what we know about learner motivation, maintaining motivation through the ARCS model and personal ownership, and the motivational benefits of game-play and game design, we can create a unique, immersive, integrated, and effective learning environment for cross-disciplinary study at the graduate level. The remainder of this paper describes in detail one such course. In it, the students were partnered with a local organization (in this instance a non-profit) and required to assist that organization in meeting one of its goals. This immediately gave the students ownership over solving a real-world problem. The course also incorporated each of the categories in the ARCS model as illustrated in Table 1 (Appendix). Finally, game design and game-play were integral parts of the course since the students were charged with providing the community partner with a functional board game that could be used to teach middle and high school students the basics of running a business.

THE COURSE

Because this project is designed to run the entire semester, it is important to provide a bit of background on the course for which it is used. The title of the course is "Managing the Regulatory, Economic, and Social Environment of Business." This course is designed to provide students with the practical knowledge of the economic and regulatory issues that arise in the business environment so that graduates will have the ability to evaluate business decisions, spot potential regulatory problems, address their ethical and social responsibilities, and minimize their risk. The course is team taught, usually by one professor from economics and one professor from law.

The syllabus for the course lays out the following learning goals:

- Legal and Social Issues
  - o Explain and apply pertinent federal and state laws and regulations.
  - o Integrate legal duties with ethical and social responsibilities.
  - o Address legal and ethical decisions and dilemmas that might arise in the context of Domestic and International business transactions,
  - o Specify actions that managers can take to create and sustain socially responsible businesses while meeting the needs of their stakeholders.
  - o Analyze a situation and understand the consequences of actions taken and their impact on the company, its stakeholders, and self.
- Managerial Economics Issues
  - o Describe risk management and its impact on personnel and labor relations.
  - o Identify and pinpoint a risk exposure as a problem to be solved with a risk management solution.
  - o Identify the variety of business issues dealing with risk management including protecting assets properly, avoiding fraud and forgery, protecting against theft, maintaining sound internal controls, internet security, and creating and maintaining sound company policies.
  - o Use economic and finance theories to evaluate cost and benefit of business decisions

Primarily, this course is intended to provide an integrative opportunity to tie together laws, regulations, and managerial concepts that are useful in strategic decision making with issues of ethics and responsibility in 21st century organizations. When using traditional lecture methods, students may have difficulty making the connections between the topics across disciplines, and can be easily bored, losing all motivation to learn. To overcome this, students partnered with a single community organization with a more holistic view on the decision-making process and the variety of factors that impact those decisions.

THE PROJECT

The project was created to not only accomplish the learning goals of the course, but also to provide a real-world, engaging experience for the students and to serve our community. The class partnered with a local non-profit, The Florida Air Museum, which provided their resources (employee time, business structure and financials) to assist students with developing an understanding of how their business functions in exchange for the creation of a learning tool they

could use in their educational programs. The Florida Air Museum provides year–round educational programs to students from elementary through high school, and was seeking a new tool to teach middle school students about business.

To meet that need, the class was charged with creating a game that incorporated the course material goals into an interactive experience that middle school students could play and understand. The challenge for the graduate students was to understand the complex nature of business issues faced by a real business to the point where they could simplify them enough to incorporate them into a board game on how to run a business, which could be understood and played by younger students.

The project was laid out into four phases:

- Phase 1: Establish preliminary goals, divide into groups and establish a timeline
- Phase 2: Build a core material foundation and gather information about the business
- Phase 3: Analyze business information and begin to design a game that would capture the nature of the business
- Phase 4: Fine-tune the game so that it finds a balance between the complexity of the real-world and playability for the given audience

The limitations in the design were driven only by the skills/abilities of the students (i.e. a lack of programming skills dictated that it would not be computer based) and the timeframe (a prototype had to be complete for the final presentation within 15 weeks). Beyond that, the design decisions were left in the hands of the class.

THE PROCESS

Since the community partner was a non-profit organization, it was decided that the class should be organized to simulate a non-profit board of directors. The students were then divided into groups—board committees--by functional areas, modeled after course objectives:
- Economics: Charged with identifying and exploring the cost/benefit and risk management components of the business' operations
- Accounting: Charged with gathering and analyzing the business' financial records
- Legal: Charged with identifying and analyzing the pertinent legal and regulatory issues the company faces
- Human Resources: Charged with identifying and analyzing the employment issues the company faces
- Social Responsibility: Charged with identifying and analyzing the ethical and social issues the company faces

Class time was divided between board meetings, lecture, on-site visits and flex-time.
- Board Meetings: Weekly meetings were held with the purpose of bringing the game design decisions to the whole class. Each functional area (committee) would prepare a report of their weekly activities, address old business, and bring up new business. The board chair and secretary would be rotated each week so that all students would have a chance at each role. The board chair would be responsible for sending out each week's agenda and the secretary would post the "minutes" of the meeting on a class "Wiggio" page. This board meeting design served several purposes. First, it allowed the cross-

disciplinary issues to be addressed, for example, if Legal brought up an issue regarding the use of volunteers and their liabilities, HR, Economics and Social Responsibility would weigh in from their respective points of view on the potential impacts of the issue. Second, it engaged the students in their own learning, keeping their motivation up throughout the course. Third, it taught the students how board meetings are conducted. Although this was not an original goal of the course, it provided the students an additional, unexpected, but beneficial learning experience.

- Lectures: Traditional lecture was used sporadically to address foundational issues in the subject areas. Readings were assigned to support the lectures and students were provided the opportunity to ask questions to help them fill knowledge gaps.
- On-Site: Meetings were held with the business to allow the students to ask questions regarding the issues the business encountered, gather data and provide updates on their progress.
- Flex-time: Class time devoted to informal meetings to address outstanding issues and allow groups to have more direct access to the professors.

In addition to the class time, students were expected to spend significant time out of class researching issues, which included both in-person and email/phone communication with the business' managers, designing the game board, developing the rules and instructions, and creating various scenario cards.

Once the students felt they had a workable game, a prototype was made so that they could play the game themselves. Through this exercise, they were able to discover potential questions, address possible issues, tweak the instructions, and feel confident about their end product. The next step was to test the game with actual middle school students. Eight students from a nearby middle school played the game while being observed by the class, which allowed the graduate students to see the relevance of their work first-hand and to have the satisfaction of knowing that what they had created actually worked.

GRADING

Students were evaluated based on their participation in class, weekly reports, overall contributions to the project (judged by both the faculty and peer evaluation) and outcome of the project (judged by both the faculty and the business' managers). The key criteria were professionalism (both in class and in interactions with the business' managers), identification and analysis of issues related their functional group, and understanding of how the issues may cross-functional areas.

THE GAME

The game that was created as a result of the class is titled "NOTAM – Notice to Air Museum: The Game" and allowed the players/teams to experience a 2 year business cycle, divided into 8 quarters, that mimicked the environment that the Florida Air Museum existed in, building towards their large fundraiser, called "Air Show". The game captures stylized decisions based on real-world issues the business faces and puts each player/team in the shoes of the executive director. Some game highlights are listed below:

- The goal of the game is to have the most total attendance at the end of the game

- Attendance is accrued at each quarter based on the number and type of airplane that each player has (See Airplane Cards in Appendix)
- When planes are acquired, players must pay a maintenance fee as well as allocate limited hangar space (See Big Decision and Hangar Sheet in Appendix)
- Revenues are accrued each quarter based on attendance
- At the beginning of the game, each player/team is asked to make some "Big Decisions" such as hiring an accountant or lawyer or buying particular type of insurance, which may impact their performance in the game. (See Big Decision and Hangar Sheet in Appendix)
- At each quarter, players are given the opportunity to make another "Big Decision".
- Players/teams take turns moving around the board in a clockwise direction via a die roll, potentially landing on a NOTAM, Airplane, Event, Blank or STOP space
  - NOTAM space: Players draw a NOTAM card which indicates a good or bad event, for example "You are being audited by the IRS. If you hired an Accountant, go to sleep. If not, pay $12,000 in fees." As the card states, the fees could have been avoided if you had hired an accountant at a cost of $8000 prior to drawing the card. (See NOTAM Card Examples in Appendix and see Big Decision and Hangar Sheet in Appendix)
  - Airplane Space: Players draw an Airplane card which indicates an airplane they have the opportunity to acquire. The cards indicate how much attendance the plan will draw each quarter, how much hangar space the plane will take up and the upfront maintenance cost the plane requires. (See Airplane Card Examples in Appendix)
  - Event space: When players land on an event space, they must follow the instructions on the board, for example "Oil Spill, Pay $2000". (See Game Board in Appendix)
  - Blank space: Players do nothing.
  - STOP space: All players must stop when they get to the STOP space, it indicates the end of the quarter where expenses must be paid, attendance is counted, revenue is received and they have the opportunity to make a "Big Decision".

Also, included in the appendices is the quick start guide.
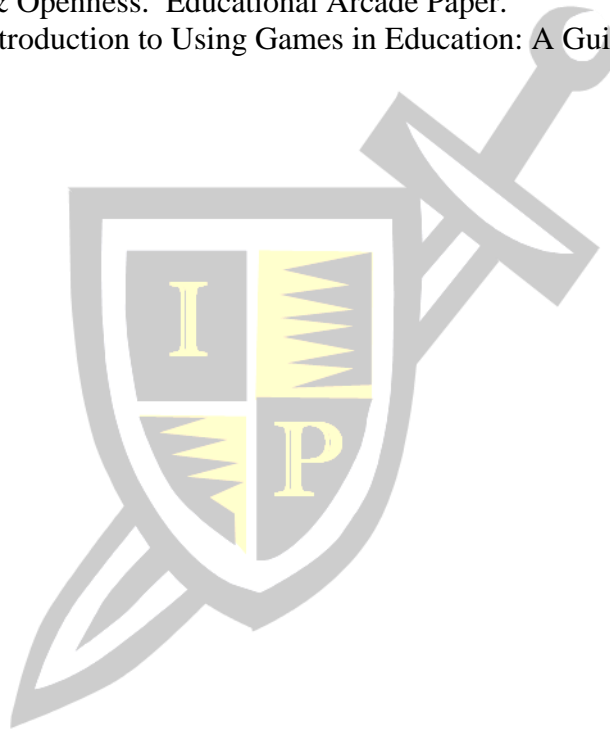
IMPLICATIONS AND CONCLUSIONS

This game provides a younger audience with an initial lesson on business, incorporating elements of accounting, risk management, law, ethics, and economics. The game play pushes players to think about how their decisions will impact their outcomes under uncertainty. Creating this game pushed the MBA students to understand the many risks, rewards and issues that businesses contend with, weigh their relative importance and boil them down to their fundamental elements in order to translate them into a playable board game for middle school and high school students.

The process provided a semester-long project, which helped students develop both soft-skills (team-work, creativity, professionalism) as well as hard-skills (managerial economics, business law, accounting foundations, ethical perspectives) in a non-traditional classroom environment. The students were able to see, in real-time, the results of their labor and make the often-difficult connection between disciplines to see the big picture of how businesses function

and the challenges they face. The student evaluations provided insight into the overall level of both receptiveness and effectiveness of the process.

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APPENDIX: TABLE 1

Table 1: ARCS Model as Applied to Cross-Disciplinary Graduate Course				
Concept	**Attention**	**Relevance**	**Confidence**	**Satisfaction**
Explanation (Francom)	Directing & Sustaining learner's attention to appropriate learning materials	The perceived relevance of subject matter to learners	A learner's level of confidence that he or she will succeed	How learner's feel about their accomplishments
Recommended Example (Francom)	Requiring learner participation	Stating present worth of the subject matter	Practicing tasks in realistic settings	Providing positive natural consequences for learning
As Applied in the Course	Students acted as a non-profit board with working committees tasked with addressing relevant topics	The goal of the class was to provide the community partner with a relevant and useable end product	Students worked with employees of a local nonprofit to develop a product that could be used by the organization in its educational program, and tested the product with student focus groups.	Student evaluations scored an average of 6.3/7 on criteria including overall satisfaction, knowledge gained, engagement and understanding the material beyond the classroom.

APPENDIX: GAME BOARD
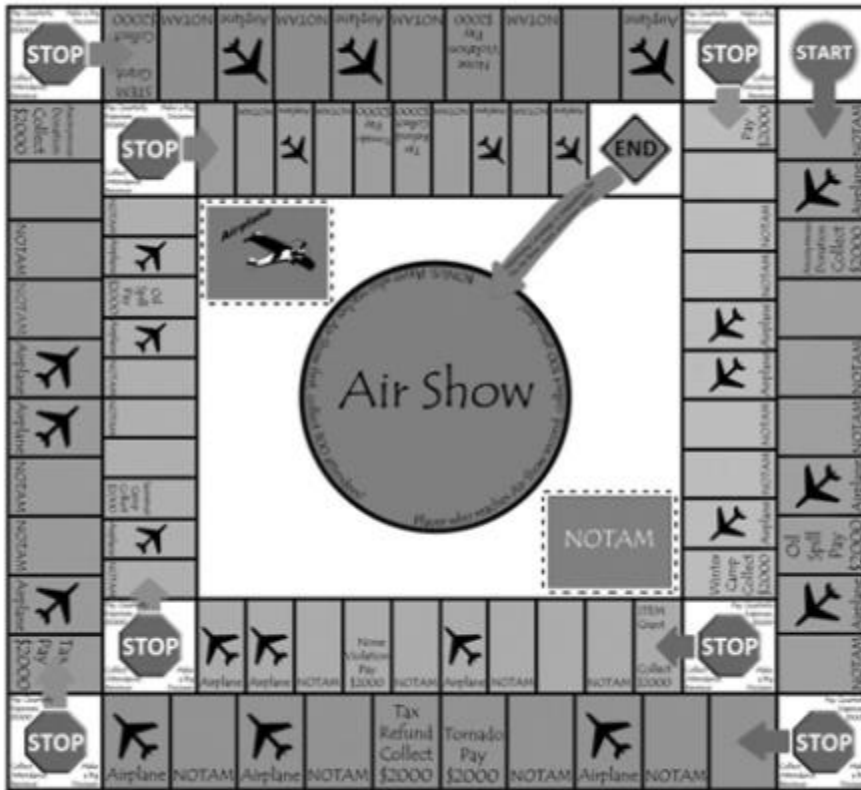
APPENDIX: QUICK START

QUICK START

OBJECT: The object of the game is to have the most attendance at the AIR SHOW at the end of the game.

SET UP AND START

- Before starting the game, shuffle and place NOTAM cards and AIRPLANE cards on suggested spaces on the game board. Select one player or a non-playing person to be the BANKER.
- Make sure there is a die and enough game pieces for everyone to play.
- Each player chooses a game piece and puts it on the START space.
- The BANKER gives $50,000 (2x$10,000; 4x$5,000; 10x$1,000) to each player.
- Each player will have a DECISION SHEET containing all BIG DECISIONS and HANGAR SPACE.
- Each player draws an AIRPLANE card from the deck, pays the maintenance cost, crosses off the indicated number of HANGAR SPACE(S) with the marker, and collects the appropriate number of ATTENDANCE chips as listed on the airplane card.
- The BANKER will control the marker and eraser and will give them to each player when needed.
- Once every player has an airplane, each player may make a BIG DECISION, cross it off the DECISION SHEET, and pay the bank the cost of the decision made.
- Once every player has an airplane and has made a big decision, each player rolls the die to determine which player will start the game. The player with the highest roll will start by rolling the die and moving the game piece the number of spaces indicated. Play then proceeds clockwise.

CONVERSION TABLE (for use at the end of the game)
10-4000= 0 attendees
5000- 9000= 100 attendees
10000-13000= 200 attendees
14000-19000= 300 attendees
20000-24000= 400 attendees
25000-29000= 500 attendees
30000-34000= 600 attendees
35000-39000= 700 attendees
40000-44000= 800 attendees
45000-49000= 900 attendees
50000 or more= 1,000 attendees
A player can at the most collect 1,000 attendees for the end-of-game marketing effort.

GLOSSARY

Aeronautic Fundraiser – a type of fundraiser to generate money for projects related to the field of aeronautics instead of relying only on revenues from admissions. Aeronautics is the science, art, theory, and practice of designing, building, operating airplanes.

Attorney - A professional person authorized to practice law, conducts lawsuits or gives legal advice. Also known as a Lawyer.

Accountant – A person who maintains the cash inflows and out flows of the business. Also has the ability to audit business accounts. Similar to a bookkeeper.

Background Check - Ensures the employer that the candidate has the background and experience he or she claims.

Environmental Improvements- Environmental works, including landscaping, tree planting, surfacing, repairs to buildings and other work designed to enhance the environmental quality of an area and also improve the efficiency of the business in hopes of generating cost savings in the long run over time.

Food Preparer Licenses – Employees or Volunteers who serve food should be licensed to do so. This could include classes and/or training in food preparation techniques and food safety.

Hangar - A large structure at an airport where aircraft can be stored and maintained.

Insurance - Promise of reimbursement in the case of loss, paid to people or companies as concerned about hazards that they have made prepayments to an insurance company. Also protects against further loss.

Maintenance Manager – Oversees workers who make repairs and perform general upkeep in or around a building. They often perform routine maintenance themselves as well. Maintenance managers may do everything from fixing broken appliances to mowing the grass.

NOTAM - In the game, this word stands for Notice to Air Museum. However, in a real setting, NOTAM stands for Notice to Airman. A NOTAM is filed with an aviation authority to alert aircraft pilots of any hazards en route or at a specific location.

Quarterly Expenses – Quarterly expenses are expenses that a company must pay for to keep in operation. One quarterly expense that every business has is payroll taxes. For the purpose of the game, quarterly expenses include salary, employee benefits, payroll taxes, office supplies, land lease, insurance, and all other operating expenses. Quarterly includes a time period of 3 months. For example, January, February, and March typically make up the first quarter for a business.

STEM Grant- A money aid given to the STEM program. STEM stands for Science, Technology, Engineering and Math.

APPENDIX: AIRPLANE CARDS

A-4 Skyhawk

Attendance 300　　　　Hangar Space 1　　　　Maintenance Cost $4000

Beech 17 Staggerwing

Attendance 300　　　　Hangar Space 1　　　　Maintenance Cost $2000

Douglas DC-5

Attendance 400　　　　Hangar Space 2　　　　Maintenance Cost $2000

APPENDIX: NOTAM CARDS

You have overpaid on your payroll taxes during the quarter.

Receive a $2000 refund.

You failed to file your 990 Tax Return in time and forgot to file an extension.

You must pay a $10,000 fine.

Little Johnny gets a tummy ache after eating a frozen hot dog. If you did food license your volunteers, blame Johnny. If you did not, pay $7000.

Your organization needs audited financial statements in order to apply for a grant. If you have hired an accountant, book a cruise. If not, pay $6000 for the audit.

APPENDIX: BIG DECISION AND HANGAR SHEET

Big Decisions

- Perform Background Check on Staff and Volunteer $5,000
- Purchase Food License $ 5,000
- Hire a Fulltime Maintenance Manager $6,000
- Hire an Accountant $8,000
- Invest in Environmental Improvements $8,000
- Hire an Attorney $10,000
- Buy Property Insurance $10,000
- Build a Second Hangar (Hangar 2) $9,000
- Extend Hangar 1 $4,000
- Extend Hangar 2 $4,000 (Only Available if You've already Built Hangar 2)

Hangar 1			Expansion

Hangar 2			Expansion