

Information Communication Improvements in B.I.G.

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Game based learning is a proven methodology of conveying complex ideas and concepts to students. Game based learning creates an environment that is safe, enjoyable, stress free, and competitive. Construction management is no exception. In the classroom, there is only one way to provide real life experiences in creating and operating a business. That is through simulation software. Simulation software allows a user to experience many of the complexities that occur in real life while playing in an educational environment. This senior project will focus on one software package called The Building Industry Game. This simulation package provides its user a way to experience real life bidding on projects, management of those projects, as well as management of their company. When using the simulation software during one of my classes, I saw the large amount of potential information waiting to be extracted from the game. Core information taught in classes Construction Management majors take, such as accounting and construction lab classes, is embedded in the simulation package. Much of this information, however, was never presented this way to students and thus was confusing for players when using the simulation software. This is the difference between learning a subject and applying the knowledge. Applying knowledge and recognizing “cause and effect” is one of the major advantages of this method of education and is what separates the classroom from the simulation environment. I believe there are many areas of improvement for the game to better communicate important information to students and thus enhance and improve the overall learning experience.

Key Words: B.I.G., Communications Improved, Simulation Software, User Analysis

Introduction

As a user of this software, the biggest hindrance to learning was understanding the underlying algorithms that ruled the outcome of the game. How would changing certain aspects of the game affect the company and how should I analyze the results. The second hindrance was the little feedback received after making a decision for your company. Only dollar amounts would change, but why would they be changing? It seemed randomness was at play when users conducted the game. With the students minimal understanding of the game, the goal became to bid jobs and pray they make you money. The goal for this game should be to make intelligent decisions, anticipate, and understand what the short and long term results will be. If you don't get the results you wanted or predicted, the user should be able to answer why that happened. The purpose of this senior project was to examine the simulation package and produce better means of communicating information to students. To do so, an in-depth analysis of areas for improvement was conducted. The intent of the analysis was to help develop a more meaningful way of portraying the information to students. Virtual software allows students to experience real world issues of running a company and understanding the complexities of it. I believe more technology should be used in teaching, however, the tools must first be designed with a user centric approach. This requires constant end-user feedback to maximize the transfer of knowledge.

There are many studies that show students learn better through the use of simulation technology. Derek T. Reamon and Sheri D. Sheppard, part of the Mechanical Engineering Department at Stanford, found in their research that simulation software is a valuable addition to the learning environment. Having a powerful teaching tool is something that can't be ignored. The utilization of this simulation package will help students learn information through an environment that is educational, safe, enjoyable, stress free, and competitive. It is important to note that simulation games are effective not because they are “fun” but because they are immersive. They require a player to make

decisions, develop goals, and adapt to standards. Simulation games allow for failure without real life consequences or detriment to ones feeling of self-accomplishment. Instead of feeling defeated, players feel the urge to try again and learn from their mistakes. As seen in a study in the *Journal of the Association of American Medical Colleges*, students felt that their experience with simulation software promoted critical thinking and active learning. Students also felt it allowed them to build confidence and practice skills in a supportive environment. At the end of the experiment, students wanted more exposure and felt the simulator allowed them to integrate basic and clinical sciences and to practice for residency (Gordon, 2001). Simulation software prompted greater problem solving skills and forced students to recall prior knowledge and apply different techniques to different situations. Simulation games provide constant feedback for every action a player makes. With different outcomes occurring instantly in front of the student, the student has no choice but to continuously focus on what will occur next. Focusing on different events every few minutes helps reengage the students mind in something new and exciting.

The ultimate challenge for this project was to create a user-friendly interface that allowed students to maximize understanding and interaction within a simulated business environment. The endeavor was further complicated by the diverse background and experiences that individual users bring to the project. Therefore, the challenge involved providing all the pertinent data that a user needs to be successful in a manner that is both intuitive and readily available. A positive end user experience was critical to achieve the goals of the simulation software. In order to accomplish this, user centric design techniques (UCD) must be employed to provide developers the unique perspective of the student. According to a study from the University of Swansea in Wales, “user centered design” has become a central, largely unquestioned, tenet of good practice for the design of interactive systems (Thimbleby, 2008).

Methodology Case Study

The current B.I.G. package holds valuable information to students learning. The intent of The Building Industry Game is to provide its users with a better understanding of bidding, estimating, scheduling, managing, and finance management within the construction industry. B.I.G. is a simulation software package that simulates running a construction company with no risk involved. While I have experience in the technology field, it was important to approach this project as a student with limited knowledge and understanding of technology. In addition, I assumed a limited time frame of seven weeks to become familiar with the package. Given these factors, I approached the project as an overwhelmed student that could easily be discouraged by difficulties understanding the simplest features of the package. Improvements could be as simple as rearranging information on a screen or adding missing information. My suggestions reflect my experience as an end-user.

Communication Hindrances and Improvements

B.I.G. is an excellent software package that conveys many complexities of running a construction company. However, there are many communication hindrances that leave the user questioning what results they are actually producing throughout the simulation. The lack of learning objectives provided for the student contributes to this issue. The intent of B.I.G. is for students to utilize their critical thinking skills and make educated decisions for running their company while also understanding how these decisions are impacting their company. The B.I.G. software has tried to engage students critical thinking skills through learning objectives, however, there are missing objectives that could fully enhance students learning abilities.

The inbox page, as seen in *Figure 1*, provides an email where invitations to bid, bid acceptances and rejections, and bond evaluations are received. On the left hand side of the page the company’s cash on hand, equity, work in progress, and bond limits are located. It appears the initial intent was to be able to see these values before bidding on future projects. While these numbers are useful when deciding what future steps to take for your company, they aren’t strategically placed for the user to access easily when bidding on the project. Furthermore, there is no indication as to what will happen to those numbers after you bid on a project or how they will be impacted throughout the projects life.

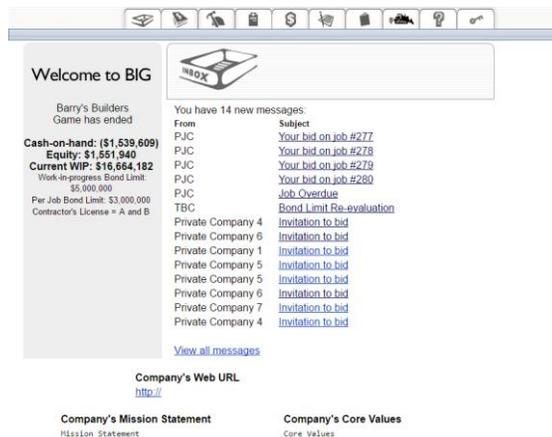


Figure 1. The Inbox Tab

The inbox tab also contains emails for bond-evaluation or re-evaluation and rejected bids due to reached limits. There is no explanation as to why your bond limits aren't changing or why you are getting rejected from bids due to reached limits. The improvements to the email tab consist of more beneficial emails to students that explain in more detail why the student was rejected and what the bond-evaluation and limit means. Additional emails such as weather reports and job labor reports could be sent to simulate real life experiences. The tab should also better portray the meaning and impacts on a company's cash on hand and equity.

The company info page, as seen in Figure 2, contains only reset password commands and the company name. The company information page should consist of current projects, the company's current finances, loans, and tracking costs. Some of this information is spread throughout the program creating communication discontinuities or missing correlations between relevant information. Having it centralized would benefit the students learning significantly. The company info page could be improved by centralizing company finances, job costs, and cost tracking on this page. Company finances would include equity, cash on hand, work in progress, loans, and bond limits. Each would also include a summary of what it is and how it is impacted by various decisions. The goal of tracking costs is to make sure people are performing, producing quality work, and you are paying the right amount for labor, materials, etc. For example, if you need 300 linear feet of piping and they only laid 298 linear feet, where did you go wrong are questions students should be internally asking. Also, a recap of your company status looking at if you are overbudget or underbudget and why it is crucial to running your project should be implemented.

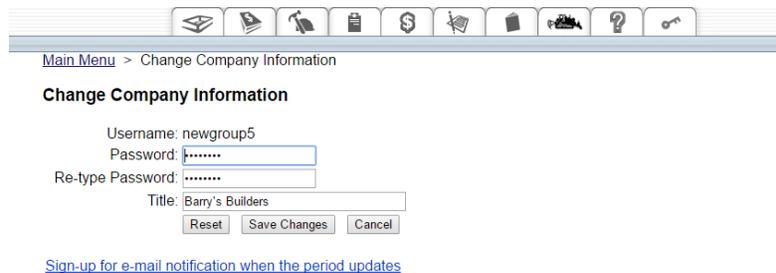


Figure 2. The Company Information Tab

The balance sheets and income statements, as seen in Figures 4 and 5, contain important information that is necessary for students understanding of the company's cash flow. There is a beauty to learning through repetition. The best way to learn something is to repeat it over and over again. In Construction Accounting we used detailed balance sheets when evaluating company finances. Utilizing similar layouts and information, students will be able to make sense of this information easily. It would be helpful to have a better explanation of what each line items means to help students learn where each expense is coming from.

Main Menu > Balance Sheet
View Report for Period: [Start](#) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Barry's Builders CONSOLIDATED BALANCE SHEETS October 31, 2019 - End of Period 17			
ASSETS		LIABILITIES and EQUITY	
Current Assets		Current Liabilities	
Cash	\$ (1,539,609)	Accounts Payable	\$ 2,621,868
Accounts Receivable	0	Current	114,468
Current	1,300,387	Retention	7,930
Retention	4,412,528	Billings in excess of costs and estimated earnings on contracts in progress	0
Costs and estimated earnings in excess of billings on contracts in progress	0	Income Taxes	0
Unbilled amounts on completed contracts	0	Loan Balances	0
Total Current Assets	4,173,306	Total Current Liabilities	2,743,366
Property and Equipment		Equity	
Construction Equipment	4,000	Retained Earnings	1,551,940
Trucks and Automobiles	15,000		
Office Equipment	6,000		
	25,000		
Less Accumulated Depreciation	0		
	25,000	TOTAL LIABILITIES AND EQUITY	\$4,295,306
Land	97,000		
	122,000		
TOTAL ASSETS	\$4,295,306		

Figure 3. The Balance Sheet Tab

Barry's Builders Consolidated Statement of Earnings and Retained Earnings Period: 17, September & October 2019	
Earnings from Construction	
Construction Revenue	\$ 5,190,147
Cost of Construction	5,081,479
Gross Profit	108,668
General & Administrative Expenses	
Office Overhead	296,400
Bidding Expense	59,308
Consulting Expense	57,600
Total G&A Expense	413,308
Earnings from Operations	(304,640)
Other Income (Expenses)	
Interest Expense	0
	0
Earnings before Taxes	(304,640)
Income Tax Estimate Adjustment	0
NET EARNINGS	(304,640)
Retained Earnings, beginning of period	1,856,580
Retained Earnings, end of period	1,551,940

Figure 4. Income Statements

The contracts in progress page, as seen in Figure 5, is too busy and may be too confusing or overwhelming for the student. Suggestions to the contracts in progress page would be to break up all the individual projects and have clickable links to review each project individually. This would give the student a narrower focus and would allow for faster access of the necessary information they are trying to pull.

Contracts In Progress Report Period: 17, September & October 2019								
Project	Original Contract	Change Orders to Date	Adjusted Contract	Cost Incurred	Estimated Cost to Complete*	Estimated Total Job Cost	Estimated Total Gross Margin	Estimated Total Gross Margin %
Job: 27 Heavy - Highways	3,982,213	721,906	4,704,119	4,414,575	<u>131,096</u>	4,545,671	158,448	3.37%
Job: 45 Heavy - Bridges	3,688,687	151,816	3,840,503	3,271,779	<u>306,993</u>	3,578,772	261,731	6.82%
Job: 156 Heavy - Highways	3,812,740	0	3,812,740	1,818,915	<u>1,880,697</u>	3,699,612	113,128	2.97%
Job: 158 Heavy - Highways	4,142,105	602,464	4,744,569	3,511,127	<u>897,336</u>	4,408,463	336,106	7.08%
Job: 213 Heavy - Mass Excavation	4,002,926	432,867	4,435,793	1,817,078	<u>2,563,239</u>	4,380,317	55,476	1.25%
Job: 237 Heavy - Bridges	5,077,247	0	5,077,247	2,543,798	<u>2,197,765</u>	4,741,563	335,684	6.61%
Job: 238 Heavy - Underground Utilities	3,207,971	133,306	3,341,277	1,940,986	<u>923,779</u>	2,864,765	476,512	14.26%
Job: 254 Heavy - Mass Excavation	4,430,914	669,134	5,100,048	2,378,347	<u>1,745,093</u>	4,123,440	976,608	19.15%
Job: 265 Heavy - Highways	4,154,019	0	4,154,019	1,047,165	<u>2,879,012</u>	3,926,177	227,842	5.48%
Job: 267 Private - Apartments	2,933,951	0	2,933,951	826,827	<u>1,225,028</u>	2,051,855	882,096	30.07%
Totals:			42,144,266	23,570,597	14,750,038	38,320,635	3,823,631	9.07%

Figure 5. The Contracts in Progress Tab

Including job cost and equipment cost ledgers, as seen in Figures 6 and 7, would be beneficial for this section to see how resources are allocated to each job. This could then be transferred back to the company info page at a high-level overview to see where resources are needed and how resource costs are allocated to each job. A summary of each item in the ledgers would be in place to help students understand where costs are coming from and what they mean.

Job 27: Heavy - Highways	
Direct Job Costs	
Labor Cost	\$ 42,560
Materials Cost	51,520
Equipment Cost	64,960
Subcontractor Cost	0
Indirect Job Costs	
Field Overhead	\$ 54,408
Liquidated Damages (38 days late @ \$0 per day)	0
Total Cost	\$ 213,448

Figures 6. The Job Cost

Equipment Ledger	
Current Period	Group: 4
Total Equipment Costs	
Rent and Lease Payments	\$ 37,056
Depreciation	\$ 11,905
Repairs and Maintenance	\$ -
Repairs	\$ 2,432
Maintenance	\$ 3,471
Tires	\$ 12,105
Total Repairs and Maintenance	\$ 18,008
Fuel and Lubrication	\$ 27,170
Taxes, Licenses and Insurance	\$ 3,153
Equipment costs allocated	\$ 97,292
Total Equipment Costs	\$ -
Reach Forklift	
Rent and Lease Payments	\$ 16,675
Depreciation	\$ 5,357
Repairs and Maintenance	\$ -
Repairs	\$ 1,621
Maintenance	\$ 2,431
Tires	\$ 9,454
Total Repairs and Maintenance	\$ 13,506
Fuel and Lubrication	\$ 12,227
Taxes, Licenses and Insurance	\$ 1,419
Equipment costs allocated	\$ 49,184

Figure 7. Equipment Cost Ledgers

The ratios report, as seen in Figure 8, is an excellent way of understanding how your company is functioning. It can be used to evaluate the financial condition of a company, including the company's strengths and weaknesses. The ratios report contains the formulas and calculates the ratio for the student but lacks in providing any information as to what that calculated number represents. Furthermore, there are no industry standards to compare your numbers to. Being able to compare your numbers would allow the user to see if they were doing well in compared to industry standards. An explanation of these ratios and how they affect your company is also needed for the student to better understand the ratios report. The ratios report will have a summary of what each ratio needs and the impacts on your company. For example, the current ratio is a liquidity ratio that measures a company's ability to pay short-term and long-term obligations. A current ratio of 1.0 indicates that current assets at least equal current liabilities.

Ratios Report
Period: 17, September & October 2019

Ratio	Average Over Past 4 Periods	Period 17 (Current)	Period 16	Period 15	Period 14	Formula
Liquidity Ratios						
Current Ratio	2.05	1.52	1.72	1.86	3.09	Current Assets / Current Liabilities
Receivable Turns	1.58	3.99	0.82	0.76	0.76	Revenue / Accounts Receivable
Payable Turns	3.61	1.86	2.54	3.71	6.32	Cost of Construction / Accounts Payable
Working Capital Turns	-3.26	-3.37	-3.26	-2.31	-4.11	Revenue / Cash-on-hand
Working Capital to WIP	-6.8%	-9.2%	-6.3%	-8.8%	-2.8%	Cash-on-hand / Work-in-Progress
Debt Ratios						
Earnings Coverage Over Interest	-	-	-	-	-	Earnings from Operations / Interest Expense
Debt to Net Worth	1.15	1.77	1.29	1.08	0.44	Total Liabilities / Equity
Operating Ratios						
Gross Profit	9.0%	2.1%	11.6%	10.6%	11.8%	Gross Profit / Revenue
Net Profit	-1.6%	-5.9%	2.2%	1.5%	-4.4%	Net Earnings / Revenue
Return on Net Worth	-4.1%	-19.6%	5.4%	3.3%	-5.4%	Profit before Tax / Equity

Figure 8. The Ratios Tab

The reschedule methods tab, as seen in Figure 9, is used to reschedule each activities duration. This is an excellent strategy for students because it teaches them how to manage a projects schedule while staying within budget and finishing the project on time. The tab, however, contains very minimal information for students to make educated decisions. All that is provided is a drop-down bar for each item to switch the method. The tab could be improved by adding costs and schedule charts. Creating a schedule to track progress alongside the methods would help students see where each method would put them. By not providing a schedule there is a loss in the student's ability to critically analyze and modify a schedule for the project. Another thing to consider adding would be a trigger in the schedule to report delays and show estimated to actual costs produced on the project as seen in Figure 10 below.

Select methods for Job 27

Clear & Grub	Method Clear&Grub3
Rough Grading	RoughGrading2
Excavation	Excavation3
Underground Piping	UndergroundPipe3
Concrete (Form & Place)	Concrete2
Backfill & Compaction	Backfill&Compact3
Aggregate Base	AggBase3
Paving	Paving3
Finish Grading	FinishGrade3

Reset Update Cancel

Figure 9. The Reschedule Methods Tab

The billing for work completed tab, as seen in Figure 10, allows students to bill the owner for the amount of work that has been completed on the project. The tab shows how much work has been completed for each activity and students must then decide how much to bill the owner based on the construction units completed. The billing portion, however, only shows the cost of work completed but does not show how much profit you should be making on the amount of work completed. When you bid on a job you create a fixed price for each construction activity. After the bid is sent in those numbers are lost and the user, if they haven't saved their work in an external document, is left questioning what they originally bid.

Bill for Job 27			
Activity	Percent Complete	Current Cost Incurred (\$)	Amount to Bill (\$)
Clear & Grub	100.00%	0	0
Rough Grading	100.00%	0	0
Excavation	100.00%	0	0
Underground Piping	100.00%	0	0
Concrete (Form & Place)	100.00%	0	0
Backfill & Compaction	100.00%	0	0
Aggregate Base	100.00%	0	0
Paving	97.66%	94,080	0
Finish Grading	80.85%	0	0
Total Amount to Bill:			0

Summary of Revenue Info from Other Reports:	
Contract Amount Billed to date:	\$4,704,119
Engineer's estimates:	
Percent job complete:	98.06%
Total revenue earned:	\$4,613,070
Total revenue earned minus billed to date:	\$184,737
Accountant's estimates:	
Percent job complete:	97.12%
Total revenue earned:	\$4,568,454
Total revenue earned minus billed to date:	\$140,121

Figure 10. The Billing For Work Completed Tab

To improve this disconnect, the billing for work completed tab should list out the original bid for that job so the user can easily translate how much they should actually be billing the owner for on each line item. Line item meaning each construction activity. The payments received tab should also be absorbed into the billing for work completed so the user can easily identify how much they billed for last time and whether it was approved or not. There should also be an estimated vs actual cost to date chart, see Figure 11, that is updated every period for the student to see if they are off schedule and budget. This will create another learning objective for the student to critically analyze and create a solution if their project is behind or ahead of schedule as well as under or over budget. The schedule shown below shows the estimated costs and completion compared to the actual costs and percentage completed. There is also a simple schedule to the left of those columns showing how much work has been completed for the activity each week. The week scale timeline could be adjusted to fit the period lengths in the game. This graphic would help students understand the efficiency of their projects and the impact of weather or labor delays more effectively.

	Cost-Loaded Baseline Schedule					Budgeted	Estimated	Estimated	Actual	Actual
	Week 1	Week 2	Week 3	Week 4	Week 5	Cost	Cost to date	% Complete	Cost to date	% Complete
Task A						\$ 8,101	\$ -	0	\$ -	0
Task B						\$ 1,746	\$ 1,117	64	\$ 1,152	66
Task C						\$ 2,493	\$ 2,244	90	\$ 2,493	100
Task D						\$ 892	\$ 687	77	\$ 589	66
Task E						\$ 5,613	\$ 5,557	99	\$ 5,613	100
Task F						\$ 3,279	\$ 3,279	100	\$ 3,279	75

See Figure 11. Cost-Loaded Baseline Schedule
Source – Stacy Kolegraff

When deciding to get a loan for your company, there are many important questions to ask. The loan tab can be seen in Figure 12 below. A student should be reviewing their company a period in advance and asking themselves if they will need a loan anytime throughout that period. Loans are important to keep your cash flow moving. In the loans tab, there should be a better explanation regarding how loans work. One suggestion would be to create a real-time loan approval process where the student must come up with an actual number based on current needs and company assets and then go through an approval process within the game. A company credit score could be earned based on how well the student pays back loans each period and that will then determine if they qualify for future loans.

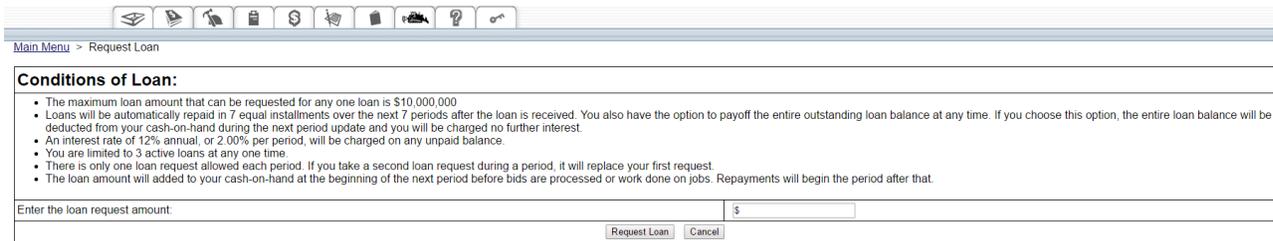


Figure 12. Loans Tab

The manage personnel tab, as seen in Figure 13, does not truly convey how hiring certain employees affects a student's company. The page allows for students to read through a potential employee resume and base their hiring decisions from what their company needs and what that potential employee can provide. There is also a report generated after every period that attempts to list how effective the company is with its current staff.

Main Menu > Employee List

Employee Type	Employee Pay per Period	# Currently Employed	Total for Employee Type	# to Hire/Layoff this Period
CEO	\$25,000	1	\$25,000	0/0
Vice President	\$20,000	0	\$0	0/0
Operations Manager	\$18,000	1	\$18,000	0/0
Comptroller	\$17,000	0	\$0	0/0
Project Executive	\$17,000	0	\$0	0/0
Chief Accountant	\$15,000	1	\$15,000	0/0
Project Accountant	\$12,500	2	\$25,000	0/0
Staff Accountant	\$7,500	1	\$7,500	0/0
Accounts Payable Clerk	\$5,000	1	\$5,000	0/0
Accounts Receivable Clerk	\$5,000	1	\$5,000	0/0
Receptionist	\$3,200	1	\$3,200	0/0
Secretary	\$4,200	1	\$4,200	0/0
Administrative Assistant	\$6,500	0	\$0	0/0
Office Engineer	\$9,200	4	\$36,800	0/0
Office Manager	\$10,800	0	\$0	0/0
Blue Print Clerk	\$3,200	0	\$0	0/0
Intern Student	\$4,000	0	\$0	0/0
Coop Student	\$5,000	0	\$0	0/0
Contracts Coordinator	\$5,000	0	\$0	0/0
Project Coordinator	\$6,500	1	\$6,500	0/0
Senior Project Coordinator	\$7,200	0	\$0	0/0

Figure 13. The Manage Personnel Tab

The current strategy set in place has students attempt to utilize their critical thinking skills to make the best decisions for company personnel. However, the report does not provide adequate information regarding how students should manage their personnel for the next period to make their company more efficient. The manage personnel tab needs to have more information regarding the effectiveness of employees. For example, there needs to be an understanding of how many projects a PM can work on at a time and how effective they will be. Or how many internal office staff you will need such as secretaries, estimators, etc. to handle phone calls and other issues. There are no efficiency scales for students to look at and assess their staff. Providing this information would allow for students to critically analyze their staff and enable them to make improved educated decisions based on employee needs. Students would also be able to understand how their employment decisions are effecting their company more clearly. The manage personnel tab and personnel report could also be combined into one page so students could easily view information and hire the right personnel without having to switch back and forth between tabs.

Tutorial

The simulation software contains vital information that users must juggle in order to keep their company in business. This creates a huge learning curve for beginners. In order to alleviate this nuance, an in-depth tutorial must be created. B.I.G. currently has a user's manual containing instructions for the game. While the manual does provide the necessary information for the user to execute the game, it is written for a more advanced audience and the layout isn't appealing to users. Looking at paragraphs of information deters the user from reading through the manual as they would rather learn on the go than read an instruction manual much like a cars manual. The new tutorial proposed will be more interactive and will consist of two items. The first being a navigation feature through the

program so the user can get their bearings. The second item will be a simple explanation of how each feature works. Both items will coincide as the tutorial moves the user through the game.

The tutorial will begin when the user logs into the game for the first time. Upon entry, it will lock the user from key strokes and an overlain video will play. The video will run through each tab and will give a brief explanation of what it is, how it works, and how it affects your company. For instance, when the video arrived to the manage personnel tab it would explain that this is the area where you hire personnel. In this tab, you will find a list of potential employees with their yearly salary and tasks they are able to perform. You will also find a personnel report that shows how effective your staff is and whether or not you need to hire or cut back your staff. This tab will affect the efficiency and outcome of your projects. With a small staff, your projects may fall behind schedule. With a large staff, you may have too many people for your current work load and will be losing money on yearly salaries. These messages will appear on screen and point to the necessary information if needed. The user will be able to go back a tab if information is missed. The current user's manual will still be utilized in the back. The tutorial should provide enough information for users to understand the more advanced areas of the game.

Creating better feedback tools is a necessity for this program. The appraisal metrics tab provides feedback on your company for the period regarding your company's finances. This allows students to understand what they need to improve on to have a more financially powerful and efficient company. The information provided currently in the metrics appraisal tab gives a higher-level analysis of the user's company. There needs to be a more simplified and more frequent feedback system implemented with the tutorial. Having real time feedback during and after a user makes a decision would allow the user to fully understand what they are doing. Having appraisal metrics throughout the program would help beginners and more advanced users understand the complexities of the game and in-turn the complexities of running a company. The goal for the simulation is to allow its users to fully understand how to run a company. Allowing them to critically think on their own is important, however, there are times when a user must be given a helping hand to understand how choosing something will impact them. Making the appraisal metrics tab cost money takes away the student's incentive to buy the report and makes them think they can figure it out on their own.

There are also additional elements that could be added to the in-place manual to benefit users understanding of the simulation. Many times, users will miss key concepts and won't understand how their decisions are affecting their company. For instance, many times users will look at the appraisal feedback tab or the personnel report and see that they have internal issues. When trying to solve these internal issues, they question how it will impact their company before making the decision. Part of the manual could contain what if statements. For example, after period one if X happens then Y will happen resulting in Z for all functions to help user understand what is going on.

Future Recommendations

The communication improvements discussed above only scratch the surface of B.I.G.'s potential. There are more beneficial strategies to help assist students learning. The simulation program doesn't just capture one subject. It captures a multitude of subjects that are deeply woven into the CM major. There is a great value to spending more time analyzing and assessing new ways to provide better communication methods for students.

Adding additional communications to students such as email would provide a more interactive learning experience. Moving emails to an outside email source would be advantageous because of all the functionality of very robust email systems on the market. Email capabilities on cellular devices have also made communication through email more practical and users would be able to be updated on events without having to log in. The new email section could also include reports from bid opening, list of bids, accepted or loss of bids, labor activity, materials cost index, weather reports, and future demands reports.

Mobile friendly/app teaching is moving closer to online platforms in the classroom. Many high schools have already adopted teaching methods through the use of iPads. With the majority of students also using smart phones on campus, the creation of a mobile app for B.I.G. would be beneficial to students learning.

Further development of “triggers” would help the student learn about real life impacts on construction jobs and ultimately their company. The development of “triggers” look at how weather reports, labor activity reports, material cost indexes, and future labor demands have impacts on your company’s cash flow and schedule.

Another area to could be the addition of a legal section. This section could look at how your company is structured, harassment cases or other legal issues in the office, and deal with mitigation strategies between parties working on the job. This section could allow users to pick their company type, for example a Limited Liability Company or Corporation to best fit their company needs in their market of choice. Market of choice being the Civil, Commercial or Residential. The next step to this tab could be to add a section for lawsuits dealing with harassment cases, litigation, and mitigation issues. This could create a new learning objective for students dealing with the legal side of the construction industry. Another important aspect could be dealing with paying your subcontractors after you have been paid by the owner. There could be issues with the owner not paying you and in-turn how do you pay your subs or withhold payment without upsetting them or dealing with legal issues.

The implementation of a solicit feedback tab within the game is crucial for the games success and improvement for years to come. There are endless possibilities for improvement and having users who play the game weigh in on the software will help the software grow exponentially in educational value. A suggestion box so students can give feedback as they learn the software should be placed in to better understand where communication hindrances occur.

The progress report is a way to see if your project is on schedule. It looks at the accumulated work done for each construction activity, the accumulated cost, and the construction units remaining for that activity. While this is a great way to see your projects progress, there are a few additions that could be considered. First, the addition of an impacts report for the project. Looking at the current weather, job market, materials cost index, and then future demands would be beneficial for students understanding of how to schedule around real world issues. Understanding how to reschedule methods after a weather delay or scheduling around labor shortages is crucial for students understanding. This would create a new learning objective for students to critically analyze how to solve scheduling issues when delays are imminent.

Finally, organizing the tabs in a more logical manner could help with communication and create an easier interface for users to utilize. Many tabs could also be combined so students wouldn’t have to navigate back and forth between tabs.

Conclusions

The Building Industry Game is an excellent tool for students to utilize. It covers vital information students learn throughout many different courses the Construction Management degree provides. There are endless possibilities for the expansion of the simulation software. While the software currently provides great learning opportunities, there is always room for improvement and additional information for educational reasons. If the suggestions above are implemented it will create a more intuitive interface that will create a more cohesive experience.

Improved User Interface

The user interface is an important part of information communication. User interface meaning the design and logical layout of the simulation package. This is what users will see when they use the software as well as what and how well they will learn through its communication. The interface needs to be intuitive. Creating easy to read visuals and graphics help communicate information to users easily and learning objectives are better understood. The communication improvements above provide new graphics and additional information to help students learn more effectively.

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